



Naval Education and
Training Command

NAVEDTRA 80370
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Nonresident Training
Course (NRTC)

Aerographer's Mate Second Class, Volume 1

Only one answer sheet is included in the NRTC. Reproduce the required number of sheets you need or get answer sheets from your ESO or designated officer.

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ERRATA #1
Stock Ordering No.
0503-LP-213-7901

June 1994

Specific Instructions and Errata for
Nonresident Training Course

AEROGRAPHER'S MATE SECOND CLASS, VOLUME 1, NAVEDTRA 80370

1. TO RECEIVE CREDIT FOR DELETED QUESTIONS, SHOW THIS ERRATA TO YOUR LOCAL COURSE ADMINISTRATOR (ESO/SCORER). THE LOCAL COURSE ADMINISTRATOR IS DIRECTED TO CORRECT THE COURSE AND ANSWER KEY BY INDICATING *THE* QUESTIONS DELETED.

2. No attempt has been made to issue corrections for errors in typing, punctuation, and so forth, which do not affect your ability to answer the question.

3. Assignment Booklet, NAVEDTRA 80370.

Delete the following questions and leave the corresponding space blank on the answer sheet.

Questions

1-2	2-3	5-11	9-63
1-54	2-40	5-46	10-25
1-63	4-46	6-28	10-27

Make the following changes:

Page 8, Assignment 2. Textbook assignment: Change pages 2-4-1 through 3-3-23 to read pages 2-4-1 through 3-3-11.

Page 35, Assignment 6. Textbook assignment: Change pages 6-4-1 through 6-7-52 to read pages 6-4-1 through 6-7-16.

Page 43, Assignment 7. Textbook assignment: Change pages 7-1-1 through 7-5-10 to read pages 7-1-1 through 7-5-5.



0503LP2137901

AEROGRAPHER'S MATE SECOND CLASS, VOLUME 1

NAVEDTRA 80370

Prepared by the Naval Education and Training Program Management
Support Activity, Pensacola, Florida

Congratulations! By enrolling in this course, you have demonstrated a desire to improve yourself and the Navy. Remember, however, this self-study course is only one part of the total Navy training program. Practical experience, schools, selected reading, and your desire to succeed are also necessary to successfully round out a fully meaningful training program. You have taken an important step in self-improvement. Keep up the good work.

HOW TO COMPLETE THIS COURSE SUCCESSFULLY

ERRATA: If an errata comes with this course, make all indicated changes or corrections before you start any assignment. Do not change or correct the training Manual (TRAMAN) or assignments in any other way.

TEXTBOOK ASSIGNMENTS: The TRAMAN for this course is Aerographer's Mate 2, Vol. 1, NAVEDTRA 10370. The TRAMAN pages that you are to study are listed at the beginning of each assignment. Study these pages carefully before attempting to answer the questions in the course. Pay close attention to tables and illustrations because they contain information that will help you understand the text. Read the learning objectives provided at the beginning of each chapter or topic in the text and/or preceding each set of questions in the course. Learning objectives state what you should be able to do after studying the material. Answering the questions correctly helps you accomplish the objectives.

BLACK DOT INFORMATION: Black dots (●) may be used in the text and correspondence course to emphasize important or supplemental information and to highlight instructions for answering certain questions. Read these black dot entries carefully they will help you answer the questions and understand the material.

SELECTING YOUR ANSWERS: After studying the text, you should be ready to answer the questions in the assignment. Read each question carefully, then select the BEST answer. Be sure to select your answer from the subject matter in the TRAMAN. You may refer freely to the TRAMAN and seek advice and information from others on problems that may arise in the course. However the answers must be the result of your own work and decisions. You are prohibited from

referring to or copying the answers of others and from giving answers to anyone else taking the same course. Failure to follow these rules can result in suspension from the course and disciplinary action by the Commander, Naval Military Personnel Command.

SUBMITTING COMPLETED ANSWER SHEETS: It is recommended that you complete all assignments as quickly as practicable to derive maximum benefit from the course. However, as a minimum, your schedule should provide for the completion of at least one assignment per month--a requirement established by the Chief of Naval Education and Training. Failure to meet this requirement could result in disenrollment from the course.

TYPES OF ANSWER SHEETS: If you received Automatic Data Processing (ADP) answer sheets with this course, the course is being administered by the Naval Education and Training Program Management Support Activity (NETPMSA), and you should follow the instructions in paragraph A below. If you did NOT receive ADP answer sheets with this course, you should use the manually scored answer sheets attached at the end of the course and follow the directions contained in paragraph B below.

A. ADP Answer Sheets

All courses administered by the NETPMSA include one blank ADP answer sheet for each assignment. For proper computer processing, use only the original ADP answer sheets. Reproductions are not acceptable.

Recording Information on the ADP Answer Sheets: Follow the "MARKING INSTRUCTIONS" on the answer sheet. Be sure that blocks 1, 2, and 3 are filled in correctly. This information is necessary for your course to be properly processed and for you to receive

credit for your work.

As you work the course, be sure to mark your answers in the course booklet because your answer sheets will not be returned to you. When you have completed an assignment, transfer your answers from the course booklet to the answer sheet.

Mailing the Completed ADP Answer Sheets: As you complete each assignment, mail the completed ADP answer sheet to:

Commanding Officer
Naval Education and Training
Program Management
Support Activity
Pensacola, FL 32559-5000

The answer sheets must be mailed in envelopes, which you must either provide yourself or get from the local Educational Services Officer (ESO). You may enclose more than one answer sheet in a single envelope. Remember, regardless of how many answer sheets you submit at a time, the NETPMSA should receive at least one a month. NOTE: DO NOT USE THE COURSE COMMENTS PAGE AS AN ENVELOPE FOR RETURNING ANSWER SHEETS OR OTHER COURSE MATERIALS.

Grading: The NETPMSA will grade your answer sheets and notify you by letter of any incorrect answers. The passing score for each assignment is 3.2. Should you get less than 3.2 on any assignment a blank ADP answer sheet will be enclosed with the letter listing the questions incorrectly answered. You will be required to redo the assignment and resubmit a new completed answer sheet. The maximum score that can be given for a resubmitted assignment is 3.2.

Course Completion: When you complete the last assignment, fill out the "Course Completion" form in the back of the course and enclose it with your last answer sheet. The NETPMSA will issue you a letter certifying that you satisfactorily completed the course. You should make sure that credit for the course is recorded in your service record.

Student Questions: Any questions concerning this course should be referred to the NETPMSA by mail using the address listed above or by telephone AUTOVON 922-1366, or commercial (904) 452-1366.

B. Manually Scored Answer Sheets

If you did not receive ADP answer sheets with this course, it is being administered by your local command and you

must use the answer sheets attached at the end of the course booklet.

Recording Information on the Manually Scored Answer Sheets: Fill in the appropriate blanks at the top of the answer sheet. This information is necessary for your course to be properly processed and for you to receive credit for your work. As you work the course, be sure to mark your answers in the course booklet, because your answer sheets will not be returned to you. When you have completed an assignment, transfer your answers from the course booklet to the answer sheet.

Submitting the Completed Manually Scored Answer Sheets: As you complete each assignment, submit the completed sheet to your ESO for grading. You may submit more than one answer sheet at a time. Remember, you must submit at least one assignment a month.

Grading: Your ESO will grade the answer sheets and notify you of any incorrect answers. The passing score for each assignment is 3.2. Should you get less than 3.2 on any assignment, the ESO will not only list the questions incorrectly answered but will also give you a pink answer sheet marked "RESUBMIT." You will be required to redo the assignment and complete the "RESUBMIT" answer sheet. The maximum score that can be given for a resubmitted assignment is 3.2.

Course Completion: After you have submitted all the answer sheets and have earned at least a 3.2 on each assignment, your command will give you credit for this course by making the appropriate entry on Page 4 of your service record.

Student Questions: Any questions concerning the administration of this course should be referred to your ESO.

NAVAL RESERVE RETIREMENT CREDIT

This course is evaluated at 18 Naval Reserve retirement points which will be credited in units as follows: Unit 1: 12 points upon the completion of assignments 1 through 7, and, Unit 2: 6 points upon completion of assignments 8 through 10. These points are creditable to personnel eligible to receive them under current directions governing the retirement of Naval Reserve personnel.

COURSE OBJECTIVES

The objective of this course is to provide Aerographer's Mates with occupational information in the following areas: world climate and weather; atmospheric physics; atmospheric circulation; air masses, fronts, and cyclones; surface weather map analysis; upper-air analysis; tropical analysis; and satellite, radar, and LDATS (Lighting Detection and Tracking System) interpretations.

Naval courses may include several types of questions-multiple-choice, true-false, matching, etc. The questions are not grouped by type but by subject matter. They are presented in the same general sequence as the textbook material upon which they are based. This presentation is designed to preserve continuity of thought, permitting step-by-step development of ideas. Not all courses use all of the types of questions available. The student can readily identify the type of each question, and the action required, by inspection of the samples given below.

MULTIPLE-CHOICE QUESTIONS

Each question contains several alternatives, one of which provides the best answer to the question. Select the best alternative, and blacken the appropriate box on the answer sheet.

SAMPLE

- s-1. Who was the first person appointed Secretary of Defense under the National Security Act of 1947?

1. George Marshall
2. James Forrestal
3. Chester Nimitz
4. William Halsey

Indicate in this way on the answer sheet:

	1	2	3	4	
	T	F			
s-1	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	---

TRUE-FALSE QUESTIONS

Mark each statement true or false as indicated below. If any part of the statement is false the statement is to be considered false. Make the decision, and blacken the appropriate box on the answer sheet.

SAMPLE

- s-2. All naval officers are authorized to correspond officially with any systems command of the Department of the Navy without their respective commanding officer's endorsement.

1. True
2. False

Indicate in this way on the answer sheet:

	1	2	3	4	
	T	F			
s-2	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	---

MATCHING QUESTIONS

Each set of questions consists of two columns, each listing words, phrases or sentences. The task is to select the item in column B which is the best match for the item in column A that is being considered. Items in column B maybe used once, more than once, or not at all. Specific instructions are given with each set of questions. Select the numbers identifying the answers and blacken the appropriate boxes on the answer sheet.

SAMPLE

In questions s-3 through s-6, match the name of the shipboard officer in column A by selecting from column B the name of the department in which the officer functions. Some responses maybe used once, more than once, or not at all.

A. OFFICER

B. DEPARTMENT

- | | |
|-------------------------------|---------------------------|
| s-3. Damage Control Assistant | 1. Operations Department |
| s-4. CIC Officer | 2. Engineering Department |
| s-5. Disbursing Officer | 3. Supply Department |
| s-6. Communications Officer | |

Indicate in this way on the answer sheet:

	1	2	3	4	
	T	F			
s-3	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	---
s-4	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	---
s-5	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	---
s-6	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	---

Assignment 1

Textbook Assignment: "Fundamentals of Meteorology"; "Atmospheric Physics." Pages 1-1-1 through 2-3-5.

Learning Objective: Define terms and recognize units of measure used in the metric and English systems.

- 1-1. The metric (cgs) system has been adopted by meteorologists to measure units of
 1. gravity, density, and force
 2. length, weight, and time
 3. centimeters, grams, and seconds
 4. circular motion, gravity, and speed
- 1-2. A dekameter is equivalent to approximately how many feet?
 1. 3.28 ft
 2. 3.93 ft
 3. 39.3 ft
 4. 32.8 ft
- 1-3. Approximately how many inches are there in 25 centimeters?
 1. 0.984 in.
 2. 9.840 in.
 3. 98.400 in.
 4. 984.000 in.
- 1-4. Weight and mass are synonymous, except one is English and the other metric.
 1. True
 2. False
- 1-5. A dyne is a measure of
 1. length
 2. force
 3. area
 4. density

Learning Objective: Describe solar features and the Sun-Earth relationship.

- 1-6. Earth receives the majority of its heat from the Sun. What percent is NOT received from the Sun?
 1. 1.0%
 2. 0.1%
 3. 0.3%
 4. 0.5%
- 1-7. What are solar winds?
 1. Winds generated on Earth by the Sun's appearance above the horizon
 2. Streams of solar particles emitted from the Sun's surface
 3. Winds generated by the pressure differences between hot and cool spots on the Sun's surface
 4. Interplanetary winds created by the constellations
- 1-8. What are sunspots?
 1. Hot spots known as solar flares
 2. Irregular bright patches on the Sun's surface
 3. Areas where the convective zone is exposed
 4. Regions of strong localized magnetic fields
- 1-9. It takes Earth approximately 365 1/4 days to circle the Sun. Approximately how many times will Earth rotate about its own axis during this time?
 1. 15 1/4
 2. 30 1/2
 3. 182 1/2
 4. 365 1/4
- 1-10. In the Southern Hemisphere, on or about what date will the greatest amount of incoming solar radiation be received?
 1. January 21
 2. March 21
 3. June 21
 4. December 22

- 1-11. The Sun's most direct rays reach their poleward limit twice in the year. What dates and names mark these occurrences?
1. March 21 and September 22; the spring and autumnal equinoxes
 2. June 21 and December 22; the summer and winter equinoxes
 3. March 21 and September 22; the spring and autumnal solstices
 4. June 21 and December 22; the summer and winter solstices
- 1-12. Which of the following statements is/are correct concerning latitude 23 1/2° N?
1. It is known as the Tropic of Cancer
 2. It is the northern extent of the Sun's most direct rays
 3. It represents one-half of the total range of motion of the Sun's most direct rays
 4. All of the above
- 1-13. The temperate zone in the Southern Hemisphere receives sunshine all year, but receives more sunshine when winter is being experienced in the Northern Hemisphere.
1. True
 2. False
- 1-14. If the Sun's radiation (Earth's incoming solar radiation) was not dispersed or filtered, Earth would eventually become too hot for life to exist as we now know it. Which of the following factors plays the major role in dispersing Earth's insolation?
1. Scattering
 2. Earth's inclination
 3. Earth's rotation
 4. Reflection
- 1-15. Earth's average albedo is between 36 and 43 percent. Which of the following terms most accurately defines albedo as it pertains to Earth and its atmosphere?
1. Sky cover
 2. Scattering capability
 3. Absorption capability
 4. Reflective capability
- 1-16. What percentage of Earth's insolation is absorbed by land and water?
1. 13%
 2. 36%
 3. 43%
 4. 51%
- 1-17. Through its atmosphere's ability to absorb and lose heat, Earth enjoys an average temperature of 15°C/59°F. If it failed to absorb short-wave radiation and radiate long-wave radiation, Earth's average temperature would be
1. -04°F
 2. -04°C
 3. -35°F
 4. -35°C
- 1-18. The poles receive far less incident radiation than the equator. What is the effect on a polar air column in relation to a column of air over the equator?
1. It is more shallow and lighter
 2. It is more shallow and heavier
 3. It is thicker and heavier
 4. It is thicker and lighter
-
- Learning Objective: Describe how pressure is measured and determine how the atmosphere is affected by pressure.
-
- 1-19. Which of the following sea level pressure(s) is/are the standard used by the International Civil Aeronautical Organization?
1. 1013.25 millibars
 2. 29.92 inches of mercury
 3. 14.7 lbs per square inch
 4. All the above
- 1-20. With a sea-level pressure reading of 1000 mb, one would expect the pressure at 18,000 feet to read
1. 200 mb
 2. 300 mb
 3. 500 mb
 4. 750 mb
- 1-21. Pressure readings vary to the greatest degree with changes in
1. latitude
 2. altitude
 3. temperature
 4. humidity
-
- Learning Objective: Mathematically convert temperature readings.
-

1-22. Convert 18° Celsius to Fahrenheit.

1. 85°F
2. 74°F
3. 64°F
4. 57°F

1-23. Convert 91° Fahrenheit to Celsius.

1. 27°C
2. 30°C
3. 33°C
4. 36°C

1-24. Minus 5° Celsius equates to what Kelvin (K) scale temperature?

1. 250°K
2. 268°K
3. 278°K
4. 283°K

Learning Objective: Describe the thermal structure and other characteristics of Earth's atmosphere.

1-25. Which of the following statements is/are correct concerning the troposphere?

1. Temperature inversions are not uncommon
2. Its thickness varies with latitude
3. Its thickness varies with the seasons
4. All of the above

1-26. For meteorological purposes, Earth's atmosphere is classified into zones or layers by its thermal structure. Working upward through the atmosphere, which of the following lists of zones is correct in its vertical order?

1. Troposphere, tropopause, mesosphere, mesopause
2. Troposphere, stratosphere, mesosphere, exosphere
3. Mesosphere, mesopause, thermosphere, exosphere
4. Stratosphere, mesosphere, exosphere, thermosphere

1-27. On some atmospheric soundings, it is sometimes possible to have more than one tropopause recorded.

1. True
2. False

1-28. The rise in temperature in the upper portion of the stratosphere is attributed to

1. the absence of water vapor
2. excessive amounts of water vapor
3. the presence of ozone
4. its relative closeness to the Sun

1-29. Which of the following zones marks the outer limit of Earth's atmosphere?

1. Mesosphere
2. Troposphere
3. Stratosphere
4. Exosphere

1-30. Which of the following zones is an electrical classification?

1. Exosphere
2. Mesosphere
3. Troposphere
4. Thermosphere

Learning Objective: Define and describe the methods of heat transfer.

1-31. At night, the Earth's surface radiates some of the heat it gains during the day, and it cools. By what process does the layer of air in contact with the Earth's surface cool?

1. Radiation
2. Conduction
3. Convection
4. Advection

1-32. The specific heat of water is 1. What does 1 represent?

1. The temperature of the water
2. The calorie requirement to raise the temperature of 1 gram of water 1° Celsius
3. The weight of the substance used in the ratio
4. The time requirement (in minutes) to raise the temperature of 1 gram of water 1° Celsius

1-33. The horizontal transport of heat is known as

1. radiation
2. conduction
3. convection
4. advection

Learning Objective: Describe water vapor (moisture) characteristics and show how moisture affects the atmosphere.

- 1-34. Earth's atmosphere is capable of holding more water vapor (water in its gaseous state) at which of the following latitudes?
1. 5°N
 2. 30°N
 3. 60°N
 4. 80°N
- 1-35. Which of the following statements concerning saturation is correct?
1. Water vapor does not exist in a volume of the atmosphere that is saturated
 2. To saturate air at the Earth's surface requires less water vapor per unit mass than at 500 mb.
 3. The degree of saturation is dependent on pressure
 4. If equal amounts of water vapor are imputed into the atmosphere, saturation is more likely to occur in polar regions before it occurs in equatorial regions
- 1-36. Which of the following occurrences will result in the condensation of water vapor?
1. Air moved over a colder surface
 2. Air lifted mechanically
 3. Air cooled by the radiational cooling process
 4. Each of the above
- 1-37. You hear someone say that it is very humid outside (high relative humidity). What does this statement imply?
1. It is very hot out
 2. Precipitation will occur
 3. Water vapor content is diminished
 4. The air is very moist
- 1-38. To determine the degree of saturation of the air, you must compute
1. absolute humidity
 2. specific humidity
 3. relative humidity
 4. mixing ratio

- 1-39. In a given mass of dry air, the ratio of the mass of water vapor to the given mass of dry air is expressed in grams per gram or grams per kilogram and is known as the
1. mixing ratio
 2. specific humidity
 3. saturation mixing ratio
 4. relative humidity
- 1-40. Under which of the following conditions will the specific humidity of unsaturated air change?
1. Temperature changes
 2. Pressure changes
 3. Air is compressed
 4. Water vapor content changes
- 1-41. Knowing that the mixing ratio of a parcel of air is 6.3 g/kg and the saturation mixing ratio is 9.0 g/kg, what is the relative humidity of the parcel?
1. 56%
 2. 63%
 3. 70%
 4. 90%
- 1-42. Which of the following statements concerning dewpoint is most correct?
1. Saturation only occurs if the air temperature is cooled to its dewpoint
 2. Saturation only occurs if the air temperature is increased to its dewpoint
 3. Saturation occurs if the air temperature is cooled to its dewpoint and there are corresponding changes in the pressure and water vapor content
 4. Saturation occurs if the air temperature is cooled to its dewpoint and the pressure and water vapor content do not change

Learning Objective: Describe the laws of motion and how motion is affected by external forces.

- 1-43. A tropical depression moved 360 nautical miles in 24 hours. This movement is referred to as
1. acceleration
 2. speed
 3. velocity
 4. inertia

1-44. A low-pressure center is stationary over the south-central North Atlantic Ocean for three days. On day four, the low moves 250 miles north. Which law of motion applies to the low's change in position?

1. Newton's first law
2. Newton's second law
3. Newton's third law
4. Dalton's law

1-45. A stationary high-pressure center begins to move, and in 12 hours, the upper-level winds move the center 60 nautical miles. What property did the high exhibit when it was stationary, and what was necessary to move it 60 nautical miles?

1. Acceleration and inertia
2. Inertia and acceleration
3. Inertia and work
4. Kinetic energy and potential energy

1-46. A destroyer is dead in the water. Which of the following forces is NOT acting upon the ship?

1. Gravity
2. A contact force
3. An at-a-distance force
4. A resultant force

1-47. A line that represents magnitude and direction is known as a

1. force
2. composite force
3. vector
4. contact force

1-48. Your ship is moving south (180°) at 15 knots, and the apparent wind reads 090 degrees at 05 knots. What is the true wind, and what name defines the forces used to compute it?

1. 160/16, component
2. 160/16, resultant
3. 340/20, component
4. 340/20, resultant

Learning Objective: Recognize the affects of pressure, density and temperature on Earth's atmosphere, and the application of the gas laws in meteorology.

1-49. What two basic particles make up the composition of all matter?

1. The atom and molecule
2. The molecule and element
3. The compound and mixture
4. The element and atom

1-50. When elements and compounds exist together without forming new compounds, they are known as a

1. mixture
2. compound
3. compounded element
4. state

1-51. Which of the following forms of matter are called fluids?

1. Solids only
2. Liquids only
3. Gases only
4. Liquids and gases

1-52. Air density can be critical to a pilot whose aircraft must take off on a short runway and/or whose aircraft is heavily loaded. Which, if any, of the following factors affects the density of the air at a given location?

1. Pressure only
2. Temperature only
3. Pressure and temperature
4. None of the above

1-53. On a warm summer morning, cumulus humulus forms at 2000 feet. By mid-afternoon, water droplets in the base of some of the cumulus are being lifted in convective currents. When these droplets rise above the freezing level, they crystallize (freeze) and remain frozen until they enter a downdraft and encounter a layer of non-freezing temperatures. In the non-freezing temperatures melting begins. In what order did the changes of state take place in this evolution?

1. Liquid to solid, solid to liquid, and liquid to vapor
2. Vapor to liquid, liquid to solid, and solid to vapor
3. Vapor to solid and solid to vapor
4. Vapor to liquid, liquid to solid, and solid to liquid

IN ANSWERING QUESTIONS 1-54 THROUGH 1-57, MATCH THE DESCRIPTION OF CHANGE IN COLUMN B WITH THE CHANGE OF STATE IN COLUMN A.

	A. CHANGES OF STATE	B. DESCRIPTIONS OF CHANGES		
1-54.	Fusion	1. Liquid to solid	1-63.	How do the molecules of helium in a pressurized bottle of helium move?
1-55.	Condensation	2. Solid to liquid		1. At varying speeds in straight lines
1-56.	Evaporation	3. Vapor to liquid		2. At varying speeds in a random manner
1-57.	Freezing	4. Liquid to vapor		3. At a constant rate of speed in a random manner
				4. At a constant rate of speed in straight lines
1-58.	What is the name given to heat that is given off or absorbed in a substance's change of state?		1-64.	Which , if any, of the following relationships concerning enclosed gases is correct?
	1. Energy			1. Increasing the temperature decreases the pressure
	2. Fusion			2. Increasing the temperature and decreasing the volume decreases the pressure
	3. Freezing			3. Decreasing the volume decreases the pressure
	4. Latent			4. None of the above
1-59.	Water molecules in the oceans are more apt to move into the atmosphere at which of the following latitudes?		1-65.	Boyle's law and the Universal gas law are very similar except
	1. 5°S			1. temperature is not considered in the Universal gas law
	2. 25°S			2. pressure is not considered in Boyle's law
	3. 25°N			3. the Universal gas law applies to the free atmosphere vice enclosed gases
	4. 60°N			4. Boyle's law is dependent on a constant temperature
1-60.	You are with someone who is wearing glasses in an air-conditioned space. When you leave the space and go outside into much warmer air, the person's glasses fog over. What process has taken place?		1-66.	To what does the gas constant in the Equation of State apply?
	1. Evaporation			1. Pressure
	2. Condensation			2. Temperature
	3. Sublimation			3. Volume
	4. Fusion			4. Molecular weight
1-61.	Just after reveille, you go up on deck and find the rails and outer bulkheads wet. There has been no precipitation or fog, and the winds and sea have been relatively calm. To what do you attribute morning dampness?		1-67.	Which of the following factors is considered in the Equation of State, but not in Boyle's, Charles' or the Universal gas laws?
	1. Humidity only			1. Density
	2. Humidity and condensation			2. Temperature
	3. Evaporation only			3. Volume
	4. Humidity and evaporation			4. Pressure
1-62.	All cirriform clouds form through the process of sublimation.		1-68.	The molecular weight of dry air is greater than moist air. How do their densities compare?
	1. True			1. Moist air is more dense than dry air
	2. False			2. Moist air is less dense than dry air
				3. Moist air is occasionally more dense than dry air
				4. Moist air and dry air do not differ in their density
Learning Objective: Recognize pressure, temperature, and density effects on the atmosphere.				

1-69. What is/are the purpose(s) of the hypsometric equation?

1. To reduce pressure
2. To determine the thickness between two layers
3. Both 1 and 2 above apply
4. To determine pressure and temperature variations

1-70. What is the approximate thickness of the 1000-500-mb layer when the layer has a mean temperature of -10°C ?

1. 5,140 meters
2. 5,097 meters
3. 4,878 meters
4. 4,778 meters

Assignment 2

Textbook Assignment: "Atmospheric Physics" (Continued); "Atmospheric Circulation. "
Pages 2-4-1 through 3-3-23.

Learning Objective: Describe the adiabatic process and determine how stability and instability affect the atmosphere.

- 2-1. When a parcel of air rises in the atmosphere, what happens to the parcel and the surrounding air?
1. The parcel expands due to lessening pressure, and its temperature, pressure, and density increase
 2. The parcel contracts due to increasing pressure, and its temperature, pressure, and density decrease
 3. The parcel expands due to lessening pressure, and its temperature, pressure, and density decrease
 4. The parcel contracts due to lessening pressure, and its temperature, pressure, and density increase
- 2-2. With regard to Earth's atmosphere, which of the following definitions pertains to temperature lapse rate?
1. The rate at which temperatures decrease or increase with altitude
 2. The rate at which temperatures decrease at night
 3. The rate of temperature decrease latitudinally
 4. The rate of temperature decrease horizontally
- 2-3. What is an inversion?
1. A decrease in temperature with height
 2. An isothermal lapse rate
 3. An increase in temperature due to subsidence
 4. An increase in temperature with height
- 2-4. If a parcel of air is lifted and remains unsaturated, it will cool at which of the following rates?
1. 1°C per 100 meters
 2. 2° or 3°C per 100 meters
 3. 5°C per 100 meters
 4. 10° C per 100 meters
- 2-5. When the actual lapse rate of a column of air is less than the dry adiabatic lapse rate but greater than the moist adiabatic lapse rate, what can we say about the air?
1. It is absolutely stable
 2. It is absolutely unstable
 3. It is conditionally stable, only
 4. It may be conditionally stable or unstable
- 2-6. A maritime polar air mass moves into western Canada and is forced aloft by the mountains of British Columbia. Prior to being lifted by the mountains, the layer of air between 850 mb and 500 mb was quite moist up to 600 mb and dry above. What should you expect concerning the stability of this layer?
1. Instability to remain the same
 2. Instability to decrease
 3. Instability to increase
 4. Stable conditions to prevail throughout the layer
- 2-7. Where would you most likely be able to determine the bases of convective clouds using surface temperatures and dewpoints?
1. Adak, Ak
 2. San Antonio, Tx
 3. San Diego, CA
 4. South China Sea

- 2-8. Stratified cloud layers on the western slope of the Appalachian Mountains of Virginia would be an indication of which of the following conditions?
1. Little or no turbulence
 2. Unstable air
 3. Hazardous flying conditions along the mountains due to strong vertical currents
 4. All of the above

Learning Objective: Recognize the affects of pressure and temperature on Earth's general circulation and explain the tri-cellular theory.

- 2-9. The unequal heating of Earth's surface is due to which of the following factors?
1. Its axis (inclination)
 2. Its rotation
 3. Differential insolation
 4. All of the above
- 2-10. Incoming solar radiation is greatest at the equator and least at the poles. What affect, if any, does this have on the atmospheric pressure in these areas?
1. Pressure is high in both areas
 2. Pressure is higher at the poles than at the equator
 3. Pressure is lower at the poles than at the equator
 4. Incoming solar radiation has no effect on pressure in these locations
- 2-11. If Earth did not rotate and its surface was uniform, in the Northern Hemisphere its surface winds would blow in what direction?
1. West to east
 2. East to west
 3. North to south
 4. South to north
- 2-12. Coriolis force is an apparent force created by
1. temperature variations between the poles and equator
 2. the tilt of the Earth's axis
 3. the Earth's rotation
 4. pressure variation between the poles and equator

- 2-13. How does Coriolis force affect moving objects?
1. It produces positive temperature changes on them
 2. It lessens the pressure gradient on them
 3. It increases and decreases their speed
 4. It forces objects to the right of their intended path in the Northern Hemisphere

- 2-14. The three cells **of** the tri-cellular theory are the

1. tropical, subtropical, and polar
2. equatorial, subtropical and polar
3. tropical, midlatitude, and polar
4. equatorial, midlatitude, and polar

- 2-15. The surface wind generated by the Earth's general circulation pattern is

1. westerly at all latitudes
2. northeasterly in the tropics and poleward of 60° N/S and westerly in the midlatitudes
3. northwesterly in the tropics and poleward of 60° N/S and westerly in the midlatitudes
4. northwesterly poleward of 60 N/S, northeasterly in the midlatitudes and easterly in the tropics

- 2-16. Which of the following regions feature(s) light and variable winds?

1. The doldrums
2. The horse latitudes
3. The regions near 30 N and 30 S
4. All of the above

Learning Objective: Define pressure gradient, centrifugal force and friction, and describe their effects on wind.

- 2-17. What force moves air in a straight line from areas of high pressure to areas of low pressure?

1. Friction
2. Centrifugal
3. Pressure gradient
4. Coriolis

2-18. What is inferred from horizontal pressure gradients classified as flat or weak?

1. Isobars are closely spaced
2. Isobars are widely spaced
3. The winds are light
4. Both 2 and 3 above are correct

2-19. The latest upper-air sounding shows the 1000-700 mb layer over your station has decreased in thickness over the last 24 hours. What does this change in thickness tell you, if anything, about the vertical pressure gradient within this stratum?

1. It has increased
2. It has decreased
3. The gradient remains unchanged because the pressures have not changed
4. Nothing without height figures

2-20. Which of the following forces has the greatest effect on wind speed?

1. Centrifugal
2. Pressure gradient
3. Friction
4. Coriolis

2-21. Which of the following forces causes the wind to begin moving from areas of high pressure toward areas of low pressure?

1. Centrifugal
2. Pressure gradient
3. Friction
4. Coriolis

2-22. What effect does centrifugal force have on cyclonic circulation?

1. It forces air out away from the center
2. It pulls air toward the center
3. It pushes air toward the center
4. It forces air from high to low pressure

2-23. What effect, if any, does the wind speed have on the centrifugal force in a high pressure system?

1. The higher the wind speed, the greater the force
2. The higher the wind speed, the smaller the force
3. The force is inversely proportional to the wind speed
4. None, the force is independent of the wind speed

2-24. Friction affects wind velocities at what levels?

1. The surface only
2. All levels
3. All levels up to the gradient level

Learning Objective: Define geostrophic, gradient and cyclostrophic wind, and recognize the effect of pressure gradient, centrifugal, coriolis, and frictional force on each type of wind.

IN ANSWERING QUESTIONS 2-25 THROUGH 2-27, MATCH THE DEFINITION IN COLUMN B WITH THE TYPE OF WIND IN COLUMN A.

	<u>A. TYPES OF WIND</u>	<u>B. DEFINITIONS</u>
2-25.	Geostrophic	1. A wind that parallels straight isobars or isoheights
2-26.	Gradient	
2-27.	Cyclostrophic	2. A wind that parallels curved isobars or isoheights
		3. A wind that approximates the gradient wind without Coriolis force being a factor

2-28. At 40,000 feet, which of the following balances of forces causes the wind to blow parallel to curved isoheights?

1. The centrifugal force and Coriolis force are in balance
2. The centrifugal force and pressure gradient force are in balance
3. The centrifugal and centripetal forces are balanced
4. The pressure gradient force and centripetal force are in balance

2-29. A low-pressure system over the Virginia Capes moves northeast without any changes occurring in the density of the air or to the pressure gradient. What happens to the gradient wind speed?

1. It decreases due to the easterly movement
2. It increases due to the northerly movement
3. It decreases due to the northerly movement
4. It remains the same

2-30. An extratropical low-pressure system is stationary 200 n. mi. south of Kamchatka. With the density of the air remaining the same and the pressure gradient decreasing, what happens to the gradient wind speed associated with this low?

1. It decreases
2. It increases
3. It remains the same
4. Both 2 and 3 are possible

2-31. Around high-pressure systems, Coriolis force opposes the

1. gradient force only
2. centrifugal force only
3. pressure gradient force and centrifugal force
4. centripetal force

2-32. Coriolis force always opposes the pressure gradient force around cyclones and anticyclones.

1. True
2. False

2-33. When measuring the gradient winds around low- and high-pressure systems using a geostrophic wind scale, how do geostrophic wind speeds compare to gradient wind speeds?

1. Geostrophic winds are stronger than the gradient winds around both systems
2. Geostrophic winds are weaker around lows and stronger around highs
3. Geostrophic winds are stronger around lows and weaker around highs
4. They do not differ

2-34. What are the most common geostrophic wind scale increments?

1. 2 mb and 15 meters
2. 4 mb and 30 meters
3. 4 mb and 60 meters
4. 8 mb and 120 meters

Learning Objective: Define secondary circulation, anti-cyclone and cyclone, and differentiate between centers of action and migratory systems. Also, recognize the role the seasons play in controlling the secondary circulation.

2-35. Which of the following statements defines Earth's secondary circulation?

1. The circulations is created and maintained by the effect of Earth's non-uniform surface and composition
2. The circulation is created by thermal differences in the atmosphere
3. It is that portion of the tertiary circulation caused by thermal differences between land and water
4. The circulation is created and maintained by the effects of Earth's non-uniform surface and composition and Earth's thermal differences

2-36. Centers of action are created by

1. wind
2. seasonal temperature differences
3. temperature differences between land and water
4. pressure belts

2-37. What is the name given to the permanent and semi-permanent high- and low-pressure cells?

1. Thermal cells
2. Migratory cells
3. Centers of action
4. Primary circulations

2-38. Some centers of action disappear at certain times of year.

1. True
2. False

2-39. In winter, what pressure systems are found in the Northern Hemisphere over Siberia, the eastern Pacific Ocean, and the eastern Atlantic Ocean?

1. High pressure at all three locations
2. LOW pressure covers Siberia, while high pressure is found over the eastern Pacific and Atlantic
3. LOW pressure at all three locations
4. High pressure covers Siberia, while low pressure is found over the eastern Pacific and Atlantic

2-40. How are the subtropical high pressure systems affected, if at all, by seasonal changes?

1. They are weaker in summer and farther poleward
2. They are stronger in summer and farther poleward
3. They are stronger in summer and nearer the equator
4. They are not affected

2-41. Which of the following pressure systems is NOT classified as a center of action?

1. Aleutian low
2. Bermuda high
3. Polar high
4. Hatteras low

2-42. Where is the largest individual secondary circulation cell in the Northern Hemisphere located?

1. North American continent
2. Asian continent
3. African continent
4. European continent

2-43. Migratory wind circulations are not classified as centers of action. why?

1. They are seasonal
2. They are not as intense
3. They are found only in midlatitudes
4. They are not persistent in location or intensity

Learning Objective: Recognize the vertical structure of pressure systems.

2-48. Pressure-system movement, shape and intensity are dependent on what factor?

1. Circulation
2. Temperature
3. Height
4. Thickness

2-49. An anticyclonic circulation in the Southern Hemisphere whose temperature pattern is such that colder temperatures are located at the circulation center is known as a

1. warm-cored low
2. warm-cored high
3. cold-cored low
4. cold-cored high

2-50. Which of the following systems have the greatest vertical extent?

1. Cold-cored lows and highs
2. Warm-cored lows and highs
3. Warm-cored lows and cold-cored highs
4. Cold-cored lows and warm-cored highs

2-51. Well developed cyclonic and anticyclonic closed circulations at the surface may or may not be evident on upper-level charts, and the same type circulations may appear on upper-level charts and not be evident at the surface.

1. True
2. False

IN ANSWERING QUESTIONS 2-44 THROUGH 2-47, SELECT THE DEFINITION LISTED IN COLUMN B THAT MATCHES THE TERM LISTED IN COLUMN A.

	<u>A. TERMS</u>	<u>B. DEFINITIONS</u>
2-44.	Anticyclone	1. An area of relatively low pressure with a counter-clockwise circulation in the Northern Hemisphere
2-45.	Anticyclogenesis	
2-46.	Cyclone	
2-47.	Cyclolysis	2. A weakening cyclonic circulation
		3. An area of relatively high pressure with a counter-clockwise circulation in the Southern Hemisphere
		4. A developing anticyclonic circulation

2-52. How does a closed cyclonic circulation in the Northern Hemisphere with warmer temperatures toward the circulation center differ from a similar circulation with colder temperatures toward the center?

1. It does not extend as far into the atmosphere
2. Its intensity lessens with height
3. It is classified as a warm-cored low
4. All of the above

2-53. A migratory closed circulation that extends well into the atmosphere is classified as

1. warm-cored
2. cold-cored
3. dynamic
4. vertically axisd

Learning Objective: Recognize tertiary circulations and describe how they affect local weather.

- 2-54. Tertiary circulations are small, localized circulations created by which of the following conditions?
1. Local heating and cooling
 2. Adjacent heating and cooling
 3. Induction
 4. All of the above
- 2-55. The monsoons of India and southeast Asia are seasonal in nature, and in winter, the monsoon winds are normally accompanied by what weather conditions?
1. Constant heavy rain
 2. Heavy rainshowers and thunderstorms
 3. Both 1 and 2 are correct
 4. Mostly clear skies
- 2-56. A sea breeze can be expected to reach its maximum intensity between what hours?
1. 0600 to 0800 local
 2. 0900 to 1100 local
 3. 1400 to 1600 local
 4. 2000 to 2200 local
- 2-57. Sea breezes are most pronounced during which of the following seasons?
1. Winter
 2. Late winter and early spring
 3. Late spring, summer and early autumn
 4. Late autumn to early spring
- 2-58. Mountains act as barriers to wind; however, if there are valleys or passages through the mountains, the wind may pass through at great speeds. Which of the following factors controls the wind speeds through such openings?
1. The orientation of the mountain range
 2. The pressure difference on each side of the mountain
 3. The pressure pattern on each side of the mountain
 4. Each of the above
- 2-59. Which of the following names applies to the cold dense air of the Greenland ice cap [10,000 feet above sea level) when it is set in motion and rushes down the cap to sea level?
1. Glacier wind
 2. Mountain wind
 3. Gravity wind
 4. Each of the above
- 2-60. What is a thermal?
1. A warm dry wind that begins at the base of a mountain and ascends the mountain slope
 2. A warm moist wind that begins at the base of a mountain and ascends the mountain slope
 3. A relatively small-scale convective current produced by strong local heating
 4. Turbulence created by moderate to strong airflow over rough or hilly terrain
- 2-61. Which of the following types of rotation is/are induced in eddies, dust devils and waterspouts?
1. Cyclonic in the Northern Hemisphere; anticyclonic in the Southern Hemisphere
 2. Anticyclonic in the Northern Hemisphere; cyclonic in Southern Hemisphere
 3. Cyclonic only
 4. Cyclonic or anticyclonic, independent of the hemisphere
- 2-62. When winds in excess of 20 knots blow perpendicular to a mountain range, what wind conditions might be expected on the lee side?
1. Updrafts only
 2. Strong downdrafts
 3. Very turbulent conditions
 4. Both 2 and 3
- 2-63. Under which of the following wind conditions may turbulence be expected?
1. Winds blow in the same direction but at different speeds
 2. Wind currents blow past each other in opposite directions
 3. Winds blow over uneven surfaces
 4. Each of the above

2-64. Mountain waves are an example of

1. large-scale vertical eddies
2. small-scale vertical eddies
3. large-scale horizontal eddies
4. small-scale horizontal eddies

IN ANSWERING QUESTIONS 2-65 THROUGH 2-68, SELECT FROM COLUMN B THE FACTS OR EXAMPLES THAT APPLY TO THE TERTIARY WINDS LISTED IN COLUMN A.

A. TERTIARY WINDS	B. FACTS AND/OR EXAMPLES
2-65. A Foehn wind	1. Horizontal and vertical circulations created when winds blow over rough terrain, mountains or other obstructions
2-66. Eddies	2. Convective currents common over bare rocky hills and sand dunes
2-67. Thermals	3. Warm katabatic winds
2-68. valley breeze	4. An ascending wind generally restricted to southward facing mountain slopes

IN ANSWERING QUESTIONS 2-69 THROUGH 2-72, SELECT FROM COLUMN B THE FACTS OR EXAMPLES THAT APPLY TO THE TERTIARY WINDS LISTED IN COLUMN A.

A. TERTIARY WINDS	B. FACTS AND/OR EXAMPLES
2-69. Mountain gap winds	1. Onshore winds that occur with great regularity in the tropics
2-70. Drainage winds	2. Winds that blow onshore in summer and offshore in winter
2-71. Monsoon	3. Light cool, katabatic winds (winds greater than 15 knots are rare)
2-72. Sea breezes	4. Winds whose existence is based on Bernoulli's theorem

Assignment 3

Textbook Assignment: "Atmospheric Circulation"; "Air Masses and Fronts."
Pages: 3-1-1 through 4-2-13.

Learning Objective: Determine the conditions necessary for the formation of air masses, identify air mass source regions, and differentiate between air mass classifications within and outside of their source regions.

- 3-1. What two factors are necessary to produce an air mass?
1. Anticyclonic circulation and non-homogeneous properties of temperature, lapse rate and moisture
 2. Large divergent flow and a widespread body of relatively uniform air
 3. Uniform surface and relative humidity
 4. Moisture and heat
- 3-2. Why are anticyclonic circulations most favorable for air mass development?
1. The horizontal outflow of air affects a much larger area
 2. The air moves slowly or is stagnant, making it easier for the air to assume the characteristics of the underlying surface
 3. The subsidence associated with these circulations is favorable for lateral mixing, thereby bringing about horizontal homogeneity
 4. All of the above are reasons
- 3-3. The properties an air mass acquires in its source region are dependent on a number of factors. Which of the following is NOT a factor in determining air mass properties?
1. Time of year
 2. Type of surface (land, water, ice)
 3. Length of time the air mass remains over the region
 4. Circulation pattern
- 3-4. Which air mass has its source region between 10°N lat. and 10°S lat.?
1. T
 2. A
 3. P
 4. E
- 3-5. Monsoon air is REALLY one of two air masses depending on the time of year. Which two air masses make up monsoon air?
1. cP and mT
 2. cP and E
 3. mP and E
 4. mP and mT
- 3-6. On what factors are air mass classifications based?
1. Temperature, humidity, and wind
 2. Season, latitude, and source region
 3. Geographic origin, moisture content, and thermodynamic process
 4. Geographic origin, temperature, and humidity
- 3-7. A cP air mass moves south out of its source region in Canada and invades the south central U.S. How would this air mass most likely be classified thermodynamically?
1. Moist (m)
 2. Cold (k)
 3. Warm (w)
 4. cool (c)
- 3-8. How is the stability of an air mass affected, if at all, when it leaves its source region?
1. It is increased only
 2. It is decreased only
 3. It may be increased or decreased
 4. It is not affected

- 3-9. It is February, and a very cold continental polar air mass pushes south over tropical waters. Which, if any, of the following changes is most likely to occur within the air mass?
1. A decrease in water vapor content takes place
 2. The lower layers are cooled by conduction
 3. An increase in stability occurs
 4. None of the above
- 3-10. Air mass stability can be changed thermodynamically or mechanically.
1. True
 2. False
-
- Learning Objective: Describe the trajectories and weather associated with the air masses that influence North America.
-
- 3-11. Over the midlatitudes of North America in winter, an air mass exhibiting surface temperatures of -18°C or colder is generally classified as
1. cPk
 2. mPk
 3. cAk
 4. cPw
- 3-12. Much can be gained from knowing the path cP and CA air masses take on leaving their source regions in North America. Which of the following statements pertains to the winter outbreaks of these air masses when their path is cyclonic?
1. Good flying conditions are the rule
 2. Cloud cover lingers along the Atlantic coast until the air mass clears the Appalachian mountains
 3. Frequent and widespread snow squalls can be expected on the leeward side of the Great Lakes
 4. Unrestricted visibilities are common on the windward side of the Appalachian mountains
- 3-13. Weather along the U.S. west coast in winter is predominantly the result of which air mass?
1. mP
 2. cP
 3. cA
 4. mT
- 3-14. What air mass is generally responsible for relatively mild weather across the U.S. in winter, and is often incorrectly referred to as mT?
1. cP with a short cyclonic trajectory over the Pacific
 2. cP with a long cyclonic trajectory over the Pacific
 3. mP with an anticyclonic trajectory along the northern border of the Pacific high
 4. Highly modified equatorial (E) air
- 3-15. The heaviest precipitation recorded in Southern California in winter is produced from what air mass?
1. mP
 2. cP
 3. mT
 4. cT
- 3-16. Maritime polar (mP) air is far more frequent along the west coast of the U.S. than the east coast. Why?
1. mP air of the Atlantic and Pacific are both more apt to move in an easterly direction, and in the Atlantic, this movement takes mP air away of the U.S. east coast
 2. cP air is heavier and more dense than mP air, and it acts as a barrier over North America
 3. The Greenland ice cap blocks mP air from moving west to the North American continent (U.S. east coast)
 4. The very warm water temperatures of the Gulf Stream rapidly modify mP air requiring it to be reclassified as mT air
- 3-17. After a week of colder than average temperatures, the southeastern U.S. comes under the influence of much warmer mT air over the Gulf of Mexico. Which of the following types of weather will likely be produced by the mT air?
1. Snow flurries
 2. Thunderstorms and tornadoes
 3. Widespread advection fog
 4. Copious rain
- 3-18. True mT air does not have dewpoint temperatures below what value?
1. 60°F
 2. 65°F
 3. 70°F
 4. 75°F

3-19. Which of the following air masses dominates most of the U.S. during the summer season?

1. mT or cP
2. mT or mP
3. mT or S
4. E or mP

3-20. Which of the following air masses dominates the U.S. Pacific coast during summer?

1. mT
2. mP
3. cP
4. S

3-21. In summer, east of the Rocky Mountains, mP air and cP air exhibit the same properties.

1. True
2. False

3-22. When mT air moves north over the Grand Banks area of Newfoundland in summer, which of the following types of weather is most likely to occur?

1. Fog
2. Heavy rain
3. Convective thunderstorms
4. Mechanical thunderstorms

3-23. Which of the following air masses is NOT found over the North American continent during winter?

1. cT
2. S
3. mT
4. cPk

3-24. Which of the following statements concerning superior air is correct?

1. It is found in the northwest U.S.
2. It is an exceptionally moist air mass
3. It is rarely found at the surface
4. Each of the above

Learning Objective: Describe the air masses of Asia, Europe, and the Southern Hemisphere.

3-25. In winter, Japan's weather is primarily influenced by which of the following air masses?

1. cP
2. mT
3. mP
4. cT

3-26. The summer monsoon of India and Burma is the result of what air mass?

1. mT
2. cP
3. mP
4. E

IN ANSWERING QUESTIONS 3-27 THROUGH 3-30 SELECT FROM COLUMN B THE AIR MASS THAT IS DESCRIBED IN COLUMN A.

	A. DESCRIPTIVE PHRASES	B. SUMMER AIR MASSES OF EUROPE
	<hr/>	<hr/>
3-27.	Modifies rapidly on leaving its source region and is reclassified as mP air	1. cA/cP 2. mA 3. mT 4. cT
3-28.	Dry air that normally brings fair weather to the British Isles and the European continent	
3-29.	Air mass is warm, dry, and unstable in its source region	
3-30.	Visibility in this air mass is better in summer than in winter	
	<hr/>	
3-31.	In winter, Great Britain occasionally experiences the effects of cA and cP air. Where do these air masses originate?	1. Iceland 2. North America 3. Greenland and Spitsbergen 4. Siberia, Finland and Lapland

IN ANSWERING QUESTIONS 3-32 THROUGH 3-35, MATCH THE AIR MASS IN COLUMN B WITH THE DESCRIPTIVE PHRASE IN COLUMN A.

A. DESCRIPTIVE PHRASES	B. WINTER AIR MASSES OF EUROPE
3-32. Usually follows a cyclonic path into Europe	1. cA/cP
3-33. Usually originates over North America	2. mP
3-34. Outbreaks often lead to cyclogenesis in the Mediterranean	3. mT
3-35. Fog and drizzle are common with this warm, very moist air mass	4. mA
3-36. Which of the following air masses originates over the Atlantic Ocean but moves over land and is classified as a continental air mass?	
	1. cP
	2. cT
	3. cA
	4. S
3-37. Australian weather is dominated by cT air; however, mT air is more of a factor along one of its four coasts. Which coast is most affected by mT air?	
	1. East
	2. West
	3. North
	4. South
3-38. Which of the following air masses is the coldest on record and where is it found?	
	1. cP - North America
	2. cA - Arctic
	3. cA - Antarctica
	4. mP - Weddell Sea
3-39. In the Southern Hemisphere, which of the following air masses is the most important in providing relief from the oppressive summer heat?	
	1. cP
	2. cA
	3. mP
	4. mA

Learning Objective: Define, describe, and classify fronts.

- 3-40. What is a front?
1. A boundary between two air masses
 2. A zone of transition between two adjacent air masses bounded by a frontal surface
 3. A zone of transition between two air masses of different densities
 4. A point where two air masses touch
- 3-41. What determines frontal classification?
1. Density differences
 2. Temperature differences
 3. Frontal movement
 4. Involved air masses
- 3-42. What classification is given to the front that separates a warm air mass from a retreating mass of cold air?
1. Warm
 2. Cold
 3. Quasi-stationary
 4. Occluded
- 3-43. What are the primary frontal zones in the Northern Hemisphere?
1. Polar and tropical
 2. Polar and arctic
 3. Arctic and tropical
 4. Polar and equatorial
- 3-44. Cold air being heavier than warm air will either underrun the warm air or be overrun by warm air.
1. True
 2. False
- 3-45. Which of the following statements refer(s) to frontal slope?
1. A front's position along the Earth's surface
 2. The zone of discontinuity between air masses
 3. The ratio of a frontal surface's elevation to horizontal extent
 4. All of the above

3-46. Which of the following statements concerning the relationship between fronts and cyclones (low-pressure centers) is correct?

1. All surface fronts develop a closed cyclonic circulation at the surface and aloft
2. Upper-level cyclones that lower to the Earth's surface always contain fronts
3. Every front is associated with a cyclone and travels with it
4. Fronts can occur anywhere but cyclones cannot

3-47. What is the average speed of wave cyclones along the polar front?

1. 10 - 15 knots
2. 15 - 20 knots
3. 20 - 25 knots
4. 25 - 30 knots

3-48. When is a frontal wave most intense?

1. When a cyclonic circulation develops
2. When a cyclonic circulation causes the cold air to overtake the warm air and forms an occlusion
3. When the pressure in the wave cyclone begins to lower
4. When the pressure in the wave cyclone reaches its lowest point

Learning Objective: Describe the conditions necessary for frontogenesis and frontolysis, and identify frontogenetical zones.

3-49. When two air masses having different densities are brought together by the prevailing wind field, what takes place?

1. A front forms
2. There's a decrease in the temperature gradient
3. The wind flow parallels the isotherms
4. Each of the above

3-50. What is cross-isothermal flow?

1. The flow of wind across isobars
2. The flow of wind across isotherms
3. The flow of wind across fronts
4. A col

3-51. Frontogenesis is most likely to occur where there is a concentration of isotherms and a circulation that sustains the concentration.

1. True
2. False

3-52. Which of the following statements concerning frontolytical processes is correct?

1. They are most effective in the lower layers of the atmosphere
2. They are more common than frontogenetical processes
3. They bring about frontal dissipation
4. Each of the above

3-53. During summer in the Northern Hemisphere, where would you most likely find the Arctic front?

1. In the North Atlantic
2. In the North Pacific
3. North of Europe
4. Northeastern Asia

3-54. Which of the following statements concerning polar fronts is correct?

1. They separate polar air from tropical air only
2. They are stronger in summer than winter
3. They are more common along eastern coasts of continents in summer
4. They are present throughout the year

Learning Objective: Describe frontal elements and general characteristics of fronts.

3-55. What three elements are used to determine whether or not a front actually exists?

1. Visibility, temperature, and pressure
2. Clouds, temperature, and wind
3. Temperature, pressure, and wind
4. Present weather, temperature, and pressure

3-56. The temperature increase within a frontal inversion and the thickness of the inversion layer provide a rough indication of

1. frontal slope
2. frontal intensity
3. turbulent mixing
4. precipitation within a frontal zone

- 3-57. Which of the following statements concerning frontal inversions is correct?
1. Cold fronts generally show stronger inversions than warm fronts
 2. They normally show up as a decrease in the lapse rate below 400 millibars
 3. Double inversions are often evident with occluded fronts
 4. Each of the above
- 3-58. Which of the following occurrences causes a front to exhibit a strong inversion layer and little or no weather activity?
1. Subsidence in the warm air above the frontal surface
 2. Subsidence in the cold air beneath the frontal surface
 3. Adiabatic warming of the cold air beneath the frontal surface
 4. Upward vertical motion in the warm air
- 3-59. In the Northern Hemisphere when a front passes your station, what change takes place in the wind direction?
1. It veers
 2. It backs
 3. It shifts in a counterclockwise direction
- 3-60. In a frontal zone, what, if anything, normally happens to the wind speeds?
1. They increase with height only
 2. They decrease with height only
 3. They may increase or decrease with height
 4. They vary on either side of the frontal zone, but maintain a steady state through the zone
- 3-61. At the surface, when a front moves beyond its associated pressure trough, how, if at all, are the winds across the front affected?
1. The wind speeds do not change, but the wind shift becomes far more apparent
 2. The wind speeds show a drastic change, and the wind shift becomes far more apparent
 3. The wind speed difference across the front continues, but the wind shift can become almost undetectable
 4. Movement out of the pressure trough affects neither wind speeds or direction
- 3-62. Which of the following factors causes frontal clouds, condensation, and weather?
1. Low pressure
 2. Friction between front and Earth's surface
 3. Vertical displacement of air along the front
 4. Each of the above
- 3-63. Which of the following frontal slopes is classified as being the steepest?
1. 1:35
 2. 1:50
 3. 1:150
 4. 1:300
- 3-64. What factor(s) contribute(s) to a steep frontal slope?
1. High wind velocity difference across the front
 2. Small temperature contrast across the front
 3. High latitude
 4. All of the above
- 3-65. In the warm air ahead of a cold front, the temperatures average 82°F/28°C. In the cold air 100 miles to the rear of the cold front, the temperatures average 64°F/18°C. What is the front's intensity based on temperature gradient?
1. Very weak
 2. Weak
 3. Moderate
 4. Strong
- 3-66. Frontal movement is determined by the
1. temperature gradient behind the front
 2. pressure difference across the front
 3. wind speed component ahead of the front
 4. wind velocity component behind the front

Assignment 4

Textbook Assignment: "Air Masses and Fronts" (continued); "Atmospheric Phenomena. "
Pages 4-3-1 through 5-1-6.

Learning Objective: Describe slow-moving cold fronts, fast-moving cold fronts, secondary cold fronts, and cold fronts aloft.

- 4-1. What is the average slope of a slow-moving cold front?
1. 1:50
 2. 1:100
 3. 1:150
 4. 1:300
- 4-2. Which of the following indications is representative of the passage of a slow-moving cold front?
1. Wind backs
 2. Sharp rise in pressure
 3. Marked temperature rise
 4. Sharp drop in the dewpoint
- 4-3. What is the average range of speed of a slow-moving cold front?
1. 5 to 10 knots
 2. 10 to 15 knots
 3. 15 to 20 knots
 4. 20 to 25 knots
- 4-4. When the cold air to the rear of a slow-moving cold front is moist and stable, and the warm air that it is displacing is also moist and stable, which of the following weather conditions is most likely to occur in the vicinity of the front?
1. Thunderstorms at and ahead of the front
 2. Thunderstorms at and behind the front
 3. Rapid clearing with the frontal passage
 4. low ceilings of stratus and fog
- 4-5. Which of the following statements describes a characteristic of slow-moving cold fronts?
1. The frontal inversion is usually very evident
 2. Isotherms parallel the front and are concentrated in the cold air
 3. Cloudiness and precipitation normally extend back into the cold air as far as the wind and isotherms parallel the front
 4. Each of the above
- 4-6. The winds that push a slow-moving cold front are more parallel to the front at lower levels than aloft.
1. True
 2. False
- 4-7. Where do squall lines develop?
1. In advance of a slow-moving cold front
 2. To the rear of a slow-moving cold front
 3. In advance of a fast-moving cold front
 4. To the rear of a fast-moving cold front
- 4-8. Which of the following factors determines the type of weather associated with a fast-moving cold front?
1. The moisture content of the cold air only
 2. The stability of the cold air only
 3. The moisture content and stability of the cold air
 4. The moisture content and stability of the warm air
- 4-9. A fast-moving cold front has an average range of speed of
1. 15 to 20 knots
 2. 20 to 25 knots
 3. 25 to 30 knots
 4. 30 to 35 knots

- 4-10. Which of the following indications is/are associated with the passage of a fast-moving cold front?
1. The dew point changes little if at all
 2. The temperature changes little, if at all, until the front is well past
 3. Rapid clearing
 4. Answers 2 and 3 are both correct
- 4-11. Which of the following upper air characteristics is associated with the passage of a fast-moving cold front?
1. Slight backing of the wind with height
 2. A double inversion; the frontal inversion and a subsidence inversion some distance to the rear of the front
 3. Isotherms are well spaced and cross the front at an angle of about 30 degrees
 4. Each of the above
- 4-12. What is a secondary cold front?
1. A fresh outbreak of very cold air to the rear of a fast-moving cold front
 2. A trough of low pressure
 3. The classification given to any summertime cold front
 4. Any cold front that is classified as unimportant meteorologically
- 4-13. Which of the following occurrences leads to the formation of a cold front aloft?
1. The mP air to the rear of a cold front crosses a mountain range and rides atop warm moist mT air
 2. Cool air overtakes colder more dense air and rides up over it
 3. Cold dense air overtakes cooler less dense air and forces it aloft
 4. Each of the above
- 4-14. A squall line is an instability line, but an instability line is NOT necessarily a squall line.
1. True
 2. False
- 4-15. Which of the following statements concerning prefrontal squall lines is correct?
1. They form about 50 to 300 miles in advance of fast-moving cold fronts
 2. Their speed is roughly equal to 40% of the 500-mb wind speed
 3. They are most common in spring and summer in the United States
 4. Each of the above
- 4-16. Which of the following weather changes occurs with the passage of a prefrontal squall line?
1. The temperature rises significantly
 2. The pressure falls
 3. The wind shifts cyclonically
- 4-17. What air mass(es) is/are involved in the development of Great Plains squall lines?
1. mT only
 2. mT and mP
 3. mT and cP
 4. mP and cP
-
- Learning Objective: Describe the characteristics and weather of warm fronts at the surface and aloft.
-
- 4-18. What is the average speed of warm fronts?
1. 5 to 10 knots
 2. 10 to 20 knots
 3. 15 to 25 knots
 4. 20 to 30 knots
- 4-19. In the Northern Hemisphere, how are the surface winds affected before and after the passage of a warm front?
1. They are generally southeasterly ahead of the front and shift to southwesterly after passage
 2. They are strongest after passage
 3. They shift in a counterclockwise direction
- 4-20. Where is nimbostratus and its accompanying precipitation most frequently found in relation to the warm front?
1. Within 300 miles of the front in the cold sector
 2. Within 300 miles of the front in the warm sector
 3. 500 miles in advance of the front
 4. 500 miles to the rear of the front
- 4-21. What is produced when the winds perpendicular to a warm front increase with height?
1. Strong overrunning of the warm air across the top of the retreating cold air mass
 2. Pronounced prefrontal cloudiness
 3. Precipitation
 4. Each of the above

4-22. When overrunning occurs, and the air is moist and unstable, which of the following weather phenomena occurs?

1. Clear skies
2. High and mid clouds only
3. Stratus and fog
4. Thunderstorms

4-23. When a warm front crosses a mountain range and encounters colder air on the lee side of the mountain, which of the following phenomena may occur?

1. The warm front moves across the top of the cold air as an upper warm front
2. Overrunning
3. Inversions are wiped out
4. Each of the above

Learning Objective: Describe the formation, structure, and characteristics of occluded fronts.

4-24. Occluded fronts are classified as which of the following types?

1. Cold only
2. Warm only
3. Cold or warm.
4. Cold, warm or cool

4-25. What is the primary difference between a warm and cold occlusion?

1. The temperature of the warm air
2. The temperature of the cold air
3. The temperature of the cool air
4. The location of the associated upper front in relation to the surface front

4-26. Which of the following occurrences takes place in the cold-occlusion process?

1. Cold air displaces the warm air to the rear of a warm front and then undercuts the relatively cooler air in advance of the warm front
2. Cool air displaces the warm air to the rear of a warm front and then rides up over the colder retreating air ahead of the warm front
3. Warm air displaces the cold air in advance of the warm front and rides up over cool air behind the cold front
4. Cold air replaces warm air and then overruns relatively cooler air ahead of the warm front

4-27. How is a cold occlusion designated that crosses the Rocky Mountains and encounters deep, cold air over the Plateau or Western Plains?

1. As an occlusion
2. As a cold front
3. As an upper cold front
4. As a warm front

4-28. Where does MOST of the precipitation occur with a cold occlusion?

1. Ahead of the occlusion, if the occlusion is old
2. To the rear of the occlusion in the occlusion's initial stages of development
3. Just ahead of the occlusion
4. Just to the rear of the occlusion

4-29. How are the isotherms affected as an occlusion matures?

1. They become more parallel to the occlusion on the cold air side
2. They become more parallel to the occlusion on the warm air side
3. They become more perpendicular as they cross the front
4. Warm and cold pockets form, and no isotherms cross the front

4-30. Which of the following situations is conducive to the formation of a warm occlusion?

1. The presence of a cPk air mass in the Gulf of Mexico
2. The invasion of mPk air into the Great Plains
3. The presence of cPk air over Canada, a warm front along its western periphery, and an approaching mPk air mass
4. The development of a low at the southern tip of the Appalachian Mountains

4-31. Where are the pressure falls associated with a warm occlusion located?

1. In advance of the upper warm front
2. In advance of the occlusion's surface position only
3. In the pressure trough behind the occlusion
4. In advance of the upper cold front and the surface occlusion

- 4-32. In a warm occlusion, where is the most severe weather located?
1. At the apex during the developmental stage
 2. At the point where the warm air is at its highest altitude
 3. In the warm sector equatorward of the apex of the occlusion
 4. At the northernmost extension of a mature occlusion

Learning Objective: Describe the characteristics of stable and unstable quasi-stationary fronts.

- 4-33. The wind shift across a quasi-stationary front is on the order of how many degrees?
1. 45
 2. 90
 3. 135
 4. 180
- 4-34. Which of the following statements is true concerning the winds above the friction level over a quasi-stationary front?
1. They parallel the front
 2. They are more or less perpendicular to the front
 3. They are non-existent
 4. They parallel the front in the warm air only
- 4-35. The weather along a quasi-stationary front is dependent on which of the following conditions?
1. The steepness of the frontal slope
 2. The stability of the warm air
 3. Undulations of the front toward the warm air
 4. All of the above conditions
- 4-36. Which, if any, of the following types of weather is associated with a quasi-stationary front when stable, warm air is advected up a steep frontal slope?
1. Tornadoes
 2. Thunderstorms
 3. Embedded showers
 4. None of the above

- 4-37. The most violent weather associated with quasi-stationary fronts occurs when
1. stable warm air is advected up a steep frontal slope
 2. unstable warm air is advected up a shallow frontal slope
 3. unstable warm air is advected up a steep frontal slope
 4. stable warm air is advected up a shallow frontal slope

Learning Objective: Describe how fronts are modified by their movement, orographic features, and underlying surfaces.

- 4-38. Which, if any, of the following effects of frontal speed on weather is correct?
1. Fast-moving fronts usually produce the most violent weather
 2. The return to favorable weather conditions takes place much quicker with a slow-moving front
 3. A front whose speed is erratic creates varying weather conditions, and is much easier to forecast
 4. None of the above
- 4-39. Which of the following aspects of a front is affected by mountain ranges?
1. Speed
 2. Slope
 3. Weather
 4. Each of the above
- 4-40. With regard to precipitation, a cold front that approaches and crosses a mountain range will generally
1. show a decrease in precipitation intensity
 2. have its area of precipitation narrowed
 3. produce greater amounts of precipitation on the leeward side
 4. produce greater amounts of precipitation on the windward side

4-41. Which of the following occurrences takes place when a warm front encounters a mountain range?

1. The warm air above the frontal surface is mechanically lifted producing severe thunderstorms
2. The frontal slope is drastically changed at higher altitudes
3. The front becomes more or less stationary on the leeward side
4. The cold air beneath the frontal surface gets cut off on the windward side

4-42. Mountain ranges prolong warm frontal precipitation and widen the precipitation area.

1. True
2. False

4-43. Which of the following statements concerning skagerraking and occlusions is correct?

1. Skagerraking occurs most frequently on the west coast of mountainous continents
2. The new low develops very rapidly
3. Skagerraking can occur with either cold or warm occlusions
4. Each of the above

4-44. When an air mass leaves its source region, it may be modified by the underlying surface in which of the following manners?

1. Moisture may be added and taken away
2. Temperatures may be increased or decreased
3. Frontal characteristics may be completely destroyed
4. All of the above

4-45. In the western Atlantic and Pacific Oceans, cold fronts of fall and winter are of greater concern to shipping than at other times of the year. Why?

1. Air mass contrast is magnified thereby producing more severe weather
2. Gale force winds are common in the cold air to the rear of these fronts
3. Low pressure systems are often spawned and develop over the warm northerly flowing waters of these regions
4. All of the above are reasons

Learning Objective: Identify the characteristics of hydrometeors.

4-46. Which of the following is NOT a hydrometer?

1. Rain
2. Rainbow
3. Drizzle
4. Spray

4-47. To be classified as rain, the water droplets that reach the Earth's surface will have a diameter of

1. .001 to .01 inch
2. .005 to .02 inch
3. .010 to .02 inch
4. .020 inch and greater

4-48. How is precipitation that falls from convective clouds classified?

1. Rain
2. Snow
3. Showery
4. Steady

4-49. Which of the following hydrometers appears as a fine mist, floats rather than falls through the air, and is frequently accompanied by fog and restricted visibilities?

1. Light rain
2. Snow
3. Drizzle

4-50. Which of the following hydrometers is considered to be the frozen equivalent of drizzle?

1. Snow grains
2. Snow pellets
3. Ice pellets
4. Ice crystals

4-51. What is another name for sleet?

1. Snow grains
2. Snow pellets
3. Ice pellets
4. Ice crystals

- 4-41. How, if at all, does sleet differ from small hail?
1. Sleet rebounds on striking the ground, hail does not
 2. Sleet is composed of snow encased in an ice layer, and hail is the exact opposite
 3. Sleet is a continuous type of precipitation, while small hail is showery
 4. They are both ice pellets and do not differ

- 4-53. Hail forms in what type of cloud?

1. Cumulus mediocris
2. Altopumulus castellanos
3. Nimbostratus
4. Cumulonimbus

- 4-54. Which of the following hydrometers is common in polar regions and mainly visible in sunlight?

1. Ice prisms
2. Ice pellets
3. Snow pellets
4. Snow grains

- 4-55. What occurs when water droplets in a cloud evaporate and then sublimate directly onto ice crystals within the cloud?

1. The ice crystals always melt
2. Precipitation begins
3. Nothing until the ice crystals melt, then the original droplets will have grown in size
4. Turbulence

- 4-56. In order for water vapor to condense and form clouds, which of the following conditions is NOT necessary?

1. Sufficient moisture
2. Hygroscopic or sublimation nuclei
3. Turbulent air currents
4. A cooling process

- 4-57. Why are hygroscopic and sublimation nuclei so important in the cloud formation process?

1. They determine the type of cloud that will form
2. Cloud formation is all but impossible without them
3. They trigger the precipitation process
4. All of the above are reasons

- 4-58. What clouds are believed to be the result of direct sublimation?

1. Cirriform
2. Stratiform
3. Cumuliform
4. Nacreous

IN ANSWERING QUESTIONS 4-59 THROUGH 4-61, MATCH THE CLOUD FORMATION TERMS FROM COLUMN B WITH THE DEFINITIONS LISTED IN COLUMN A.

A. DEFINITIONS

B. TERMS

- 4-59. Cooling brought about by orographic or frontal lifting of air

1. Hygroscopic nuclei

- 4-60. Very small minute particles with an affinity for water

2. Accretion
3. Mechanical cooling

- 4-61. The accumulation of ice crystal layers brought about when super-cooled water droplets collide with ice crystals

-
- 4-62. What are the upper limits of cirriform clouds (based on etage classification) in the tropics, middle latitudes, and polar regions?

1. 80,000, 45,000, and 25,000 feet
2. 60,000, 45,000, and 25,000 feet
3. 60,000, 30,000, and 16,600 feet
4. 20,000, 16,500, and 10,000 feet

- 4-63. Which of the following clouds is classified as belonging to one etage but may extend into other etages?

1. Altopumulus
2. Altostratus
3. Nimbostratus
4. Stratus

IN ANSWERING QUESTIONS 4-64 THROUGH 4-67, MATCH THE CLOUD GENERA IN COLUMN B WITH THE DEFINITIONS LISTED IN COLUMN A.

<u>A. DEFINITIONS</u>	<u>B. CLOUD GENERA</u>
4-64. Fibrous blue or gray veil or sheet	1. Cirrocumulus
4-65. Thin whitish veil that often produces halos	2. Cirrostratus
4-66. Small white globular masses that resemble balls of cotton	3. Altocumulus
4-67. Flattened globular masses that appear in lines, groups, and waves	4. Altostratus

4-68. The cloud species castellanus applies mainly to which of the following cloud genera?

1. Cumulus
2. Stratus
3. Altocumulus
4. Cirrus

4-69. A cumulonimbus cloud that produces hanging pouchlike protuberances is known as

1. tuba
2. castellanus
3. mammatus
4. congestus

4-70. Elongated cloud masses in the shape of lenses or almonds are classified as

1. humilis
2. stratiformis
3. fractus
4. lenticularis

4-71. The fair weather cumulus clouds of the tropics have little vertical extent and are classified as

1. humilis
2. mediocris
3. fractus
4. castellanus

Assignment 5

Textbook Assignment: "Atmospheric Phenomena" (continued) ; "Climatology and World Weather."
Pages: 5-1-6 through 6-3-4.

Learning Objective: Identify the various forms of fog.

- 5-1. Which of the following facts about fog is incorrect?
1. Fog is most easily described as a cloud at the Earth's surface
 2. All fogs are composed of minute water particles only
 3. Fog depth and density are quite variable
 4. Local geography and topography can play a major role in the formation and dissipation of fog
- 5-2. Where and when is the formation of radiation fog most common?
1. Over cold waters at night
 2. Over land at night
 3. Over land in the early afternoon
 4. Over coastal waters in the early morning
- 5-3. How does wind speed affect radiation fog?
1. Calm winds cause a shallow fog layer to form
 2. Winds of 5 to 10 knots create turbulent currents that increase the depth of the fog
 3. Winds greater than 10 knots usually cause the fog to lift, thereby forming low scud, stratus, or stratocumulus
 4. All of the above
- 5-4. Which of the following conditions is most conducive to the formation of radiation fog?
1. Low pressure, light winds, and overcast skies
 2. Low pressure, light winds, and clear skies
 3. High pressure, light winds, and clear skies
 4. High pressure, light winds, and overcast skies
- 5-5. What are advection fogs?
1. Fogs produced by the movement of warm air over a colder land or water surface
 2. Fogs that form in the clear night air over warm waters
 3. Fogs produced across air mass frontal boundaries
 4. Fogs of the tropics
- 5-6. Which of the following types of fog is not classified as advection fog?
1. Sea fog
 2. Arctic sea smoke
 3. Upslope fog
 4. Steam fog
- 5-7. Most fog is destroyed (lifted) when the wind speed over a fog enshrouded area increases. Which of the following classifications/types of fog is most likely to persist in wind up to 26 knots?
1. Land advection fog
 2. Sea fog
 3. Upslope fog
 4. Radiation fog

- 5-8. Which of the following classifications/types of fog is most likely to occur in winter, when an arctic outbreak pushes off the U.S. east coast over warm Gulf Stream waters?
1. Sea fog
 2. Steam fog
 3. Land advection fog
 4. Radiation fog
- 5-9. Which of the following statements concerning frontal fog is correct?
1. Frontal fog is the result of evaporation of falling rain
 2. It forms in the cold air mass
 3. This fog begins as low clouds that eventually lower to the ground
 4. Each of the above
- 5-10. On some mornings, grass, plants, and possibly your car will be wet with dew while the road and some large objects will be dry. Why do some surfaces remain dry?
1. Micro air temperature differences
 2. Micro dew point variations
 3. Some surfaces retain heat longer and fail to cool to the dew point
 4. Some surfaces cool far too fast for the moisture to accumulate on them
- 5-11. Which of the following hydrometers occurs when supercooled water droplets strike exposed objects at temperatures at or below freezing?
1. Hoarfrost
 2. White dew
 3. Glaze
 4. Rime
- 5-12. With regard to classification, how does spray differ from blowing spray?
1. Wind speed
 2. Visibility
 3. Wave heights
 4. Droplet size
- 5-13. Tornadoes travel at what average range of speed?
1. 0 to 5 knots
 2. 7 to 15 knots
 3. 12 to 20 knots
 4. 22 to 34 knots
- 5-14. Which of the following areas is most conducive for the formation of tornadoes?
1. Cols
 2. 30 miles to the rear of short-wave troughs
 3. 75 to 180 miles in advance of fast-moving cold fronts
 4. In areas of warm air overrunning cold air
- 5-15. Which of the following conditions is NOT indicative of tornado formation?
1. Strong convergent winds at the surface
 2. Suppressed convection up to the minus 10°C isotherm
 3. Marked convective instability
 4. Strong horizontal wind shear
- 5-16. Upon observing the development of a water spout, how can an observer tell, if it is of the local or tornadic variety?
1. Size
 2. Stability index
 3. Development process
 4. Vertical extent of convective clouds
-
- Learning Objective: Identify the characteristics of lithometeors (haze, smoke, dust, sand, and dust devils) .
-
- 5-17. Which of the following lithometeors reduce(s) visibility in a veil-like cover?
1. Smoke
 2. Dust storms
 3. Haze
 4. Sand storms

IN ANSWERING QUESTIONS 5-18 THROUGH 5-21, MATCH THE LITHOMETEOR IN COLUMN B WITH THE CHARACTERISTICS IN COLUMN A.

	<u>A. CHARACTERISTICS</u>	<u>B. LITHOMETEORS</u>
5-18.	Appears yellowish or orange when viewed against a bright background	1. Dust devils
		2. Haze
		3. Smoke
5-19.	Created by intense surface heating and steep lapse rate	4. Dust
5-20.	Causes the Sun's disc to appear red in the morning and evening	
5-21.	Makes distant objects appear tan or gray	
<hr/>		
5-22.	Your station's visibility markers are set at 1/8, 1/4, 3/8, 1/2, 3/4, 1, 1 1/2, 2, 2 1/2, 3, 4, 5, 6, 7, and 15 miles. What is the maximum distance (by marker) that your observer will be able to see in a severe dust storm?	
		1. 1/8 mi
		2. 1/4 mi
		3. 3/8 mi
		4. 1/2 mi

Learning Objective: Identify the character and characteristics of light and describe reflection and refraction.

- 5-23. Which of the following statements is NOT a characteristic of photometeors?
1. They appear as luminous patterns in the sky
 2. Many are cloud related
 3. They help in describing the state of the atmosphere
 4. They are all precursors of bad weather
- 5-24. When light encounters any substance, which of the following occurrences might take place?
1. Refraction only
 2. Reflection or refraction
 3. Absorption or refraction
 4. Absorption, reflection, or refraction

- 5-25. Visible light occupies that portion of the electromagnetic spectrum between
1. 4000 and 7000 angstroms
 2. 2500 and 4000 angstroms
 3. 1200 and 2500 angstroms
 4. 400 and 1100 angstroms
- 5-26. How does the Moon produce moonlight?
1. It is a luminous body and produces its own light
 2. It absorbs light from the Sun and regenerates it at night
 3. It reflects the light it receives from the Sun
 4. Through a combination of reflection, absorption, and refraction
- 5-27. A substance permits the passage of light through it, but the light appears clouded, and viewing things through such a substance is impaired. This substance is described as being
1. transparent
 2. translucent
 3. opaque
 4. fluorescent
- 5-28. An object that allows virtually 100 percent of the light striking it to pass through exhibits the property of
1. opacity
 2. translucency
 3. transparency
 4. absorptivity
- 5-29. When none of the light waves that strike a medium pass through it, the medium is termed
1. opaque
 2. absorbent
 3. translucent
 4. transparent
- 5-30. A ray of light striking a mirror perpendicularly is referred to as the
1. angle of reflection
 2. angle of refraction
 3. normal
 4. reflected light
- 5-31. What is the term given to the angle between a reflected light ray and a perpendicular light ray?
1. Angle of incidence
 2. Angle of reflection
 3. Angle of refraction
 4. The normal angle

- 5-32. When light passes through a medium that changes the direction of the light, the light is being
1. refracted only
 2. reflected only
 3. reflected or refracted
 4. absorbed and reflected
- 5-33. When a light ray passes from one medium into another of greater density at an angle of 45 degrees, how is the light ray affected?
1. It slows and bends away from the normal
 2. It slows and bends toward the normal
 3. It is reflected at a 45 degree angle
 4. It slows, but its path is not altered
- 5-34. What are the six distinct colors of the visible spectrum?
1. Red, orange, yellow, green, blue, and brown
 2. Yellow, green, blue, orange, violet, and red
 3. Blue, green, yellow, orange, black, and white
 4. White, black, gray, yellow, blue, and red

Learning Objective: Identify the characteristics of photometers (halos, coronas, rainbows, fogbows, mirages, looming, scintillation, and crepuscular rays) .

- 5-35. Halos are almost exclusively associated with which of the following cloud forms?
1. Cumuliform
 2. Stratiform
 3. Cirriform
- 5-36. Which of the following differences distinguishes coronas from halos?
1. Coronas are usually much larger than halos
 2. The outer ring of a corona is red, while a halo's is violet
 3. Coronas are formed by refraction of light through ice crystals, while halos are caused by the diffraction of light by water droplets
 4. Coronas form around the Sun and Moon while halos form only around the Sun

- 5-37. What color is usually seen on the outer arc of a rainbow?
1. Blue
 2. Red
 3. Yellow
 4. Green
- 5-38. Mirages are produced when light is
1. absorbed in a very dense cold air mass
 2. reflected off a very hot surface such as a desert
 3. refracted when passing through layers of air with highly different densities
 4. reflected, refracted, and diffracted in hot air
- 5-39. What is the term given to the phenomena that causes stars near the horizon to twinkle and change color?
1. Iridescence
 2. Looming
 3. Superior mirage
 4. Scintillation
- 5-40. What is "looming"?
1. An atmospheric phenomenon that causes objects over the horizon, which would otherwise not be seen, to become visible
 2. A phenomenon that causes stars to twinkle and change color near the horizon
 3. An inferior mirage
 4. A form of iridescence
- 5-41. A luminous beam of sunlight passing through a break in the clouds and extending to the Earth like a spotlight is known as
1. iridescence
 2. scintillation
 3. a crepuscular ray
 4. a sunstroke

Learning Objective: Identify the characteristics of electrometers (thunderstorms, lightning, auroras, and airglow) .

- 5-42. Which of the following atmospheric conditions is necessary for the formation of thunderstorms?
1. High temperatures and contrasting air masses
 2. Conditionally stable air and high humidity
 3. Moist, conditionally unstable air and a lifting mechanism
 4. A weak horizontal temperature gradient, low-level turbulence, and high humidity
- 5-43. Which of the following statements is true concerning the makeup of thunderstorms?
1. They consist of only one convective cell
 2. A cell's life cycle usually lasts 1 to 3 hours
 3. There are three distinct stages in the life cycle of a cell
 4. In the initial stages of development updrafts prevail throughout the cell
- 5-44. Which of the following lapse rates would most likely NOT be found in a thunderstorm?
1. .45/100 meters
 2. .75/100 meters
 3. 7.0 /1000 meters
 4. 7.5 /1000 meters
- 5-45. What is considered to be the most hazardous level for flying in a thunderstorm?
1. The base
 2. The middle level
 3. The upper level
 4. The freezing level
- 5-46. The stronger the turbulence in a thunderstorm, the less intense the precipitation.
1. True
 2. False
- 5-47. Which of the following statements concerning the winds associated with thunderstorms is correct?
1. Microbursts, macrobursts, and first gusts occur in all convective cells
 2. Microbursts are produced by violent updrafts
 3. The wind speed of the first gust is usually the highest recorded in a storm
 4. Macrobusts normally last 2 to 3 hours
- 5-48. What is the Earth's normal electrical field?
1. Ground negative and air positive
 2. Ground positive and air negative
 3. Ground and air both positive
 4. Ground and air both negative
- 5-49. Within a thunderstorm cloud, where is lightning most frequently encountered?
1. Several thousand feet below the freezing level
 2. At the freezing level
 3. Between the freezing level and 15°F
 4. Between the freezing level and the base of the cloud
- 5-50. Auroras most commonly occur
1. in thunderstorms
 2. near the Earth's magnetic poles
 3. when rarefied gases invade the lower atmosphere
 4. near the equator
- 5-51. Which of the following factors distinguishes airglow from an aurora?
1. Airglow is fainter
 2. Airglow does not shimmer as much as an aurora
 3. Airglow appears in middle and lower altitudes, while auroras are a feature of high altitudes
 4. Each of the above
-
- Learning Objective: Differentiate between climate and climatology; describe the climatic elements of temperature, precipitation, and wind; and define terms used to express climatic elements and the methods used to derive these terms.
-
- 5-52. Which of the following definitions best describes climate?
1. The scientific study of the weather of a region
 2. The sum total of the Earth's atmospheric variables
 3. The average state of the Earth's atmosphere over any given location over a long period of time
 4. The general weather of a region

5-53. Which approach to climatology provides the *most* useful information to Aerographer's Mates in their travels around the world?

1. Physical climatology
2. Descriptive climatology
3. Dynamic climatology
4. Mesoclimatology

5-54. Which of the following types of climatic studies is usually likely be used to position runways for a new naval air station?

1. Microclimatology
2. Mesoclimatology
3. Macroclimatology
4. Physical climatology

5-55. Of the following climatic elements, which is considered to be the most important?

1. Pressure
2. Temperature
3. Wind
4. Precipitation

5-56. Moisture modifies temperature, while, at the same time, it is also influenced by temperature.

1. True
2. False

5-57. In most countries of the world, the amount of precipitation in climatic studies is expressed in what increments?

1. Inches
2. Centimeters
3. Millimeters
4. Centiliters

5-58. What are resultant winds?

1. The wind directions and speeds for a given level in the atmosphere
2. The vectorial average of all wind directions and speeds for a given period of time
3. The vectorial average of all wind directions and speeds for a given period of time, at a specific place
4. The wind directions and speeds for a specific place

5-59. Which of the following climatic terms is being determined when the highest and lowest temperatures of the day are added together and divided by 2?

1. Mean
2. Mode
3. Median
4. Normal

5-60. The extreme lowest temperature ever recorded at your station is -22°F. Which of the following climatic terms applies to this temperature?

1. Extreme low
2. Absolute low
3. Absolute minimum
4. Extreme absolute minimum

IN ANSWERING QUESTIONS 5-61 THROUGH 5-64, MATCH THE CLIMATIC TERMS IN COLUMN B WITH THE DEFINITIONS LISTED IN COLUMN A.

	<u>A. DEFINITIONS</u>	<u>B. CLIMATIC TERMS</u>
5-61.	Extreme highest and lowest values recorded for any given meteorological element	1. Extreme
5-62.	value at the midpoint of an array	2. Mode
5-63.	Value occurring with the greatest frequency	3. Median
5-64.	Highest or lowest value of a particular element over a given period of time	4. Absolute

5-65. What temperature is normally used as the standard base temperature in computing heating degree days?

1. 85°F
2. 75°F
3. 65°F
4. 60°F

5-66. On the first day of your local power company's heating season, five heating degree days are measured. What does this number represent?

1. The number of kilowatts of energy used above the average number required to cool to a standard temperature
2. The difference between the first day's mean temperature and a temperature standard
3. An index of required energy
4. Standard deviation

5-67. Which of the following statements is correct with regard to average and standard deviation?

1. (+ or -) signs are critical in these computations
2. Average deviations use arithmetic averages of data, while standard deviations use actual measurements
3. A standard deviation is the square root of an average of squared mean deviations

IN ANSWERING QUESTIONS 5-68 THROUGH 5-75, USE THE FOLLOWING MONTHLY INFORMATION. (HIGHS AND LOWS ARE DEGREES FAHRENHEIT) .

<u>February</u>	<u>High</u>	<u>Low</u>	<u>February</u>	<u>High</u>	<u>Low</u>
1	41	21	15	27	11
2	39	21	16	25	09
3	39	19	17	25	10
4	29	15	18	26	11
5	27	12	19	18	05
6	30	13	20	16	03
7	32	15	21	16	04
8	37	19	22	17	08
9	37	21	23	19	13
10	40	23	24	23	14
11	40	26	25	26	16
12	41	27	26	29	18
13	39	19	27	32	21
14	37	16	28	33	22

5-68. What is the mean high temperature (rounded off) for the month?

1. 37°
2. 32°
3. 30°
4. 26°

5-69. What is the range of the high temperatures?

1. 24° to 26°
2. 41° to 29°
3. 30°
4. 25°

5-70. What is the extreme mean monthly temperature?

1. 15°
2. 22°
3. 31°
4. 32°

5-71. What is the mode of the low temperatures?

1. 15°
2. 19°
3. 21°
4. 27°

5-72. What are the medians of the high and low temperatures?

1. 29.0 and 15.0°
2. 29.5 and 15.5°
3. 30.0 and 15.5°
4. 32.0 and 16.0°

5-73. When you use 41°F as the standard, what is the number of degree days for the first seven days of the month?

1. 71
2. 86
3. 109
4. 133

5-74. What is the average daily temperature deviation?

1. 6°
2. 7°
3. 8°
4. 9°

5-75. What is the standard deviation (rounded off) of the temperature for the month?

1. 6°
2. 7°
3. 8°
4. 9°

Assignment 6

Textbook Assignment: "Climate and Climatology. " Pages 6-4-1 through 6-7-52.

Learning Objective: Recognize climatic zones and climatic types as they relate to the classification of climate.	Learning Objective: Identify the controlling factors that affect climate.
6-1. Which of the following lists represents the climatic zones? <ol style="list-style-type: none">1. Arctic, Antarctic, Polar, Mid-latitudes, Tropical, and Equatorial2. Arctic, Polar, Midlatitudes, and Tropical only3. Arctic, Temperate, Equatorial4. Polar, Temperate, and Tropical	6-6. Which of the following climatic controls has the greatest effect on climatic elements? <ol style="list-style-type: none">1. Latitude2. Ocean currents3. Topography4. Land and water distribution
6-2. Which of the following factors is most commonly used to limit the extent of each climatic zone? <ol style="list-style-type: none">1. Lines of latitude based on solar (light) zones2. Isotherms3. Precipitation lines4. Lines depicting plant growth differences	6-7. Compared to water, approximately how many times faster does land heat and cool? <ol style="list-style-type: none">1. 62. 23. 84. 4
6-3. Climatic classifiers use the same factors when classifying types of climate. <ol style="list-style-type: none">1. True2. False	6-8. Air temperature contrasts over oceans are relatively minimal between day and night and winter and summer because of <ol style="list-style-type: none">1. water's higher absorption rate of insolation2. the subtropical anticyclones' positions3. the constancy of sea surface temperatures due to mixing processes4. Earth's land and water distribution
6-4. Which of the following climatic classifiers places a great deal of emphasis on the relationship between precipitation and evaporation? <ol style="list-style-type: none">1. C. W. Thornthwaite2. W. Koppen3. G. T. Trewartha4. Each of the above	6-9. The seasonal change in the worldwide temperature gradient is greater in the Northern Hemisphere than in the Southern Hemisphere. Why? <ol style="list-style-type: none">1. The differences in the land and water distribution between the two hemispheres2. The Southern Hemisphere's longer summers3. The absence of cP air in the Southern Hemisphere4. All of the above are reasons
6-5. Koppen's five climatic types are based on <ol style="list-style-type: none">1. temperature only2. precipitation amounts only3. the effectiveness of precipitation4. the effect of temperature and precipitation on plant growth	

6-10. Mountains affect which climatic element the most?

1. Wind
2. Temperature
3. Precipitation
4. Cloud cover

6-11. Why are climates cooler along west coasts of continents than along east coasts of continents?

1. Prevailing westerly winds
2. Presence of mountain ranges which impede cold air
3. Cold ocean currents flow along the west coasts, while warm ocean currents flow along east coasts
4. Higher albedoes

6-12. The infamous fog that invades San Francisco Bay during the summer is caused by

1. upwelling
2. contrasting temperatures between the Bay and the California current
3. radiational cooling
4. warm, moist air being advected over the cold California current

6-13. Climatically, the Grand Banks of Newfoundland and the Kamchatka Peninsula of eastern Asia are well known for

1. upwelling
2. their extensive fogs
3. extremely cold summers
4. cyclogenesis

6-14. When comparing climates of heavily wooded areas to nearly open areas in the same region, how do the heavily wooded areas differ, if at all?

1. They have lower humidities
2. The wind speeds are considerably higher
3. The maximum and minimum temperatures are higher
4. They will not differ if in the same region

Learning Objective: Describe the use of climatological data in meteorology and what references and services are available.

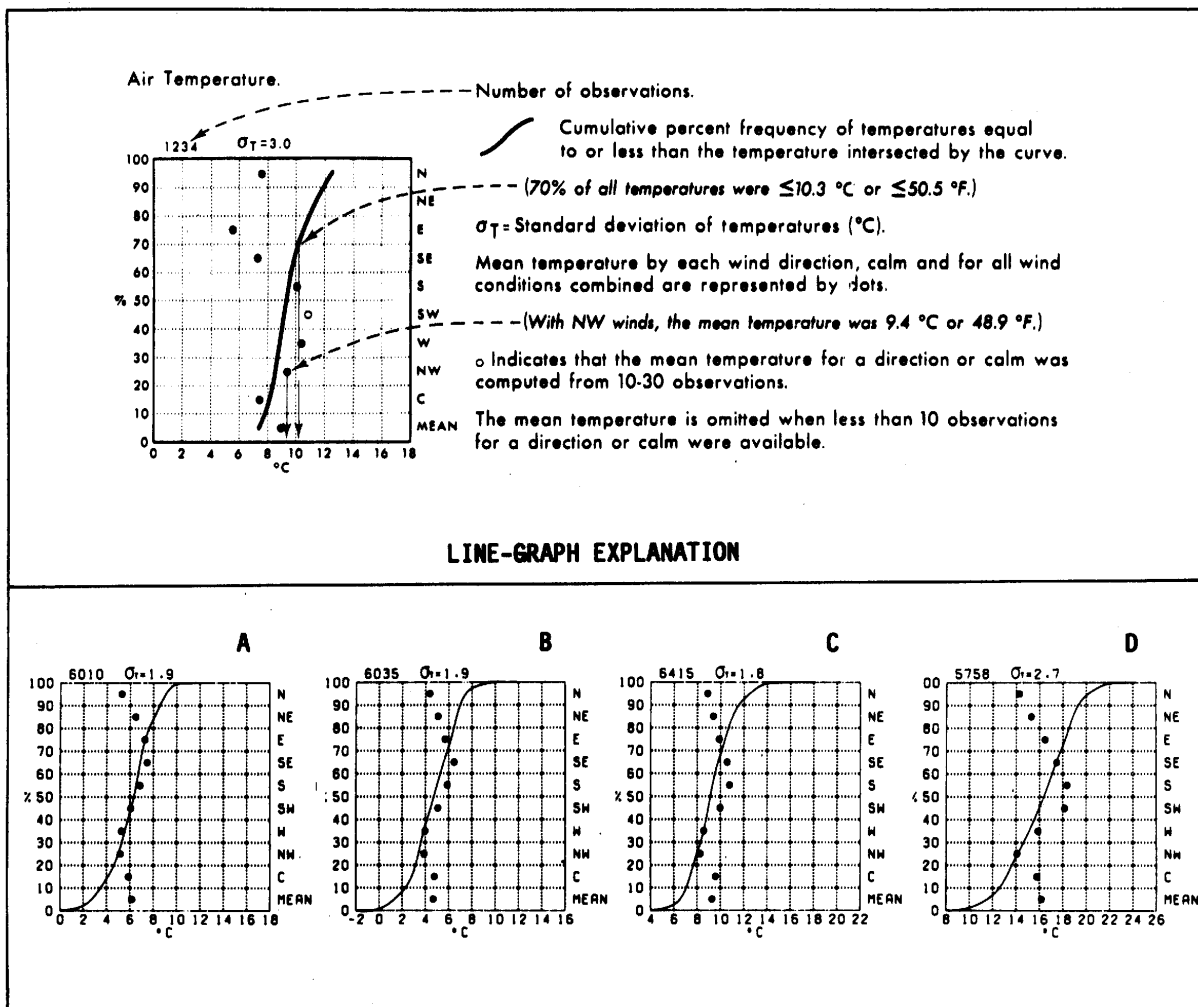


Figure 6A

IN ANSWERING QUESTIONS 6-15 THROUGH 6-17, REFER TO THE LINE GRAPHS (AND EXPLANATION) IN FIGURE 6A. FIGURE 6A SHOWS LINE GRAPHS TAKEN FROM THE U.S. NAVY MARINE CLIMATIC ATLAS OF THE WORLD, VOL. 1, FOR THE MONTH OF OCTOBER.

6-15. In graph A, what is the mean temperature when the wind is from the southwest?

1. 2°C
2. 4°C
3. 6°C
4. 8°C

6-16. In graph B, freezing temperatures occur with what percentage of frequency in October?

1. 1%
2. 20%
3. 28%
4. 46%

6-17. Of the four stations represented in graphs A through D, which one has the highest standard deviation of temperature?

1. A
2. B
3. C
4. D

6-18. Worldwide climatological records are maintained at which of the following commands?

1. NAVEASTOCEANCEN Norfolk, VA.
2. COMNAVOCEANCOM Bay St. Louis, MS.
3. FLENUMOCEANCEN Monterey, CA.
4. NAVOCEANCOMDET Ashville, NC

6-19. Which of the following climatic information is available and produced only upon request?

1. Summary of Meteorological Observations (SMOS)
2. Cross-Wind Summary
3. Local Climatological Data Summary (LCD)
4. Worldwide Airfield Summary

6-20. How often is the SMOS updated?

1. Annually
2. Biannually
3. Triannually
4. Every 5 years

6-21. A complete listing of climatological references is available in which of the following publications?

1. Climatic publications prepared for Commander, Naval Oceanography Command
2. Guide to Standard Weather Summaries (NAVAIR 50-1C-534)
3. Navy Stock List of Forms and Publications, NAVSUP 2002
4. All of the above

6-22. A prospective graduate of AG C-1 has orders to Guantanamo Bay, Cuba. Which of the following publications provides a limited amount of climatology but provides valuable information on local and area weather with regard to this station?

1. U.S. Navy Marine Climatic Atlas of the World
2. Guantanamo Bay's Local Area Forecaster's Handbook
3. Naval Intelligence Survey
4. Worldwide Airfield Summaries

6-23. Forecaster's guides for data-sparse areas and areas of high naval interest may be available from

1. NAVOCEANCOMDET Asheville, NC
2. COMNAVOCEANCOM
3. Naval Environmental Prediction Research Facility, Monterey, CA
4. Air Weather Service Environmental Technician Application Center

6-24. In two months, your ship is scheduled to embark on a 6-month Mediterranean deployment. The meteorological officer wants climatic data on each port that is scheduled to be visited. What step(s) do you take to get this data?

1. Task the nearest NAVOCEANCOMFAC
2. Draft a request for climatic support to COMNAVOCEANCOM through your chain of command
3. Use your ship's climatic publications; then, if required, request assistance from the nearest Naval oceanography Command activity
4. Request the data from NAVOCEANCOMFAC Bay St. Louis, MS

6-25. Climatology should always come into play in operational planning that extends beyond the range of forecasting techniques.

1. True
2. False

Learning Objective: Identify the various types of oceanic and continental weather and climates.

6-26. Which of the following characteristics is associated with maritime climates?

1. Minimal cloudiness
2. Little precipitation
3. Small diurnal temperature range
4. Large annual temperature range

6-27. The amount of radiant energy absorbed by the sea when the Sun is directly overhead is approximately what percent?

1. 3
2. 6
3. 25
4. 97

6-28. Most of the Sun's radiation that reaches Earth's surface waters is absorbed within what minimum depth?

1. One meter
2. Two meters
3. Three meters
4. Four meters

- 6-29. Which, if any, of the following statements is characteristic of the interchange of radiation between Earth's oceans and the atmosphere?
1. The interchange is a short-wave radiation exchange
 2. The interchange is primarily dependent on the sea-surface temperature and the amount of water vapor in the atmosphere
 3. The interchange is solely dependent on the time of day and season of the year
 4. None of the above apply
- 6-30. Convective activity is most likely to occur when
1. warm air moves over cold ocean waters
 2. cold air moves over warm ocean waters
 3. warm air moves over warm ocean waters
 4. cold air moves over cold ocean waters
- 6-31. When is evaporation of Earth's surface waters most intense?
1. When the vapor pressure of the atmosphere is greater than that of the surface water
 2. When the vapor pressure of the atmosphere and the surface water coincide
 3. When the vapor pressure of the surface water exceeds the vapor pressure of the atmosphere
 4. When the air temperature exceeds the water temperature
- 6-32. Oceans are an abundant source of moisture, but precipitation occurs much more frequently over land than over the oceans for which of the following reasons?
1. Orographic influences
 2. Stronger temperature contrasts
 3. Greater vertical mixing
 4. All of the above
- 6-33. Atmospheric soundings show that a layer of moist air exists in the tropics. During favorable weather, what is the mean depth of this layer?
1. 2000 to 3000 feet
 2. 3000 to 5000 feet
 3. 5000 to 8000 feet
 4. 5000 to 12000 feet
- 6-34. Within the temperate latitudes of the North Atlantic and Pacific Oceans, where are the most active frontal systems found?
1. Along the west coasts of North America and Asia
 2. Along the east coasts of North America and Asia
 3. Along the northern boundary of the subtropical high-pressure systems
 4. Along the eastern boundary of the subtropical high-pressure systems
- 6-35. In winter in the North Atlantic Ocean, what is the average number of days that passes between polar outbreaks?
1. 3 1/2
 2. 5 1/2
 3. 3
 4. 4
- 6-36. What are cyclone families?
1. Polar outbreaks
 2. A series of Midwestern tornadoes
 3. The fronts associated with polar outbreaks
 4. A series of cyclonic waves that form along the polar front
- 6-37. Which of the following occurrences is synonymous with the splitting of the Pacific subtropical high in winter?
1. A more vigorous polar front off the Asiatic east coast
 2. Severe cyclones in the Gulf of Alaska
 3. Two polar fronts coexist in the North Pacific
 4. The northeast trade winds are reinforced
- 6-38. What is the primary flight hazard associated with mT air on the east side of a subtropical high?
1. Coastal fog
 2. Turbulence
 3. Thunderstorms
 4. Heavy rain and low ceilings
- 6-39. Which, if any, of the following factors is the primary controller of Arctic weather and climate?
1. Land-sea-ice distribution
 2. Mountain barriers
 3. Insolation
 4. None of the above

- 6-40. During the Arctic summer, the distinction between Arctic and polar air masses almost disappears.
1. True
 2. False
- 6-41. Which of the following statements is correct concerning Arctic air masses in winter?
1. Humidity is high
 2. Cloudiness and precipitation increase
 3. Temperatures are usually between 0° and 10°C
 4. A large temperature inversion exists in the lower few thousand feet over land
- 6-42. Which of the following statements is characteristic of the flying weather in the Arctic?
1. It is worst during the transition period between the seasons
 2. Fog is a major problem over land in summer
 3. Low ceilings and visibilities are most frequent in winter
 4. High winds, blowing snow, and turbulence are more frequent in summer
- 6-43. The summers of the Canadian Archipelago are best classified as
1. hot and long
 2. cold and long
 3. cool and short
 4. warm and short
- 6-44. Strong surface winds are most likely to occur within the interior of the Arctic region during which of the following seasons?
1. Winter
 2. Fall and winter
 3. Spring and fall
 4. Summer and fall
- 6-45. Which of the following annual precipitation amounts is representative of Arctic coastal areas and the Arctic ice pack?
1. 3 to 7 in.
 2. 5 to 15 in.
 3. 8 to 11 in.
 4. 10 to 20 in.
- 6-46. Ice fog is most likely to occur when the air temperature is around how many degrees Celsius?
1. 0
 2. -15
 3. -30
 4. -45
- 6-47. Diamond dust is a name that applies to
1. Arctic smoke
 2. Arctic sea smoke
 3. Arctic haze
 4. ice fog
- 6-48. In the Arctic, the Sun, Moon, and other objects near the horizon often appear distorted. Why?
1. Aurora borealis
 2. Inversion induced mirages
 3. The highly transparent air
 4. Whiteouts
- 6-49. In addition to equal amounts of sky light and reflected light, what other conditions are necessary to bring about a whiteout?
1. Broken snow cover, and clear sky
 2. Broken snow cover, and an overcast sky
 3. Unbroken snow cover, and clear sky
 4. Unbroken snow cover, and a uniformly overcast sky
- 6-50. The lowest recorded temperature in the world was observed in
1. Siberia
 2. Greenland
 3. Canadian Archipelago
 4. Antarctica
- 6-51. Which of the following areas of the United States is favorable for the development of storm (low-pressure) centers?
1. Ohio Valley
 2. Tennessee Valley
 3. Central Idaho
 4. Great Plains
- 6-52. Which of the following regions of the United States has a cold, dry climate in winter and a warm, dry climate in summer?
1. Central Plains
 2. Intermountain West Central
 3. Southwest Pacific Coast
 4. Southeast and Gulf States

- 6-53. The chief flight hazard in the south-western desert and mountain area of the United States is
1. high level turbulence
 2. spring and summer thunderstorms
 3. haze
 4. dust devils
- 6-54. Tornadoes are a climatic feature of which of the following areas of the United States?
1. Central Plains
 2. Southeast United States
 3. Intermountain west central area
 4. Southwest Pacific coast area
- 6-55. Why is the southeast and Gulf states area of the United States an especially difficult area for making forecasts?
1. Stagnating frontal systems, fog, and Gulf stratus
 2. Air-mass thunderstorms
 3. Rapidly moving squall lines
 4. Various combinations of all the above reasons
- 6-56. The influx of maritime air into western Europe results in
1. low-temperature extremes
 2. infrequent precipitation
 3. high humidity
 4. mostly clear skies
- 6-57. Which of the following European areas experiences the least amount of change in its temperature extremes between summer and winter?
1. European Atlantic coast
 2. The Rhine Valley
 3. Eastern Europe
 4. The northern Alpine region
- 6-58. The Asian continent is dominated by
1. high pressure in winter and low pressure in summer
 2. low pressure in winter and high pressure in summer
 3. low pressure year round
 4. high pressure year round
- 6-59. If a relatively dry excursion into north east South America is planned, which month would be most suitable?
1. January
 2. June
 3. October
 4. November
- 6-60. Southern Chile experiences a climate similar to that experienced by what area of the United States?
1. Northwest coast
 2. Southwest coast
 3. Northeast coast
 4. Southeast coast
- 6-61. Why do the climatic zones of Africa lack sharp distinction?
1. Africa is an island continent
 2. There are no prominent mountain ranges in Africa
 3. In Africa, the zones are controlled by the ITCZ
 4. Africa is under the influence of only one air mass
- 6-62. Which of the following climatic elements is the most important in Africa?
1. Temperature
 2. Wind
 3. Precipitation
 4. Cloud cover
- 6-63. The sub-equatorial region of Africa experiences marked seasonal rainfall. What five-month period is associated with the rainy season?
1. Jan - May
 2. Apr - Aug
 3. Aug - Dec
 4. Nov-Mar
- 6-64. Climatically, where is the wettest region of Africa?
1. North central
 2. Equatorial
 3. Southwestern
 4. Southeast coastal
- 6-65. What is the average variation in maximum temperatures in the interior of Australia between summer and winter?
1. 15°F
 2. 22°F
 3. 28°F
 4. 31°F
- 6-66. What portion of Australia is under the influence of mT air?
1. Northern 1/3
 2. Eastern 1/3
 3. Southern 2/3
 4. Western 3/4

6-67. Climatically, southern New Zealand is wetter than northern New Zealand.

1. True
2. False

Assignment 7

Textbook Assignment: "Fundamentals of Surface Chart Analysis. " Pages 7-1-1 through 7-5-10."

- | | |
|--|---|
| <hr/> <p>Learning Objective: Identify the fundamental principles and procedures needed for surface chart analysis.</p> <hr/> | |
| <p>7-1. What is the first step that an analyst should take when analyzing a surface weather map?</p> <ol style="list-style-type: none">1. Indicate and label each high and low2. Sketch isobars in frontal areas3. Draw the isobars in order to delineate highs, lows and other features of the pressure pattern4. Ensure that past history has been transferred to the current chart | <p>7-5. Why are shipboard observations generally more representative than land station observations?</p> <ol style="list-style-type: none">1. The best observers are at sea2. The ocean surface is more uniform than land surfaces3. There are fewer computations to make4. For each of the above reasons |
| <p>7-2. Cyclical changes that occur over a 24-hour period are known as</p> <ol style="list-style-type: none">1. diurnal variations2. climatic variations3. phased changes4. celestial changes | <p>7-6. What is the most representative weather element?</p> <ol style="list-style-type: none">1. Sea-level pressure (from stations at or near sea level)2. Temperature3. Wind4. Dewpoint |
| <p>7-3. You should question the validity of a report for which of the following reasons?</p> <ol style="list-style-type: none">1. It is inconsistent with nearby reports2. There are internal inconsistencies3. It doesn't fit in with the past history of the area4. For each of the above reasons | <p>7-7. In reducing station pressure to sea-level pressure, which of the following factors must be taken into account?</p> <ol style="list-style-type: none">1. Elevation and temperature2. Elevation and moisture content3. Elevation, temperature, and moisture content4. Elevation, temperature, density and moisture content |
| <p>7-4. What is the first step you take when either an element in a report or an entire report is questionable?</p> <ol style="list-style-type: none">1. Draw to it2. Throw it out3. Reason out the error and correct the report4. Check the original message | <p>7-8. Why are three-hourly pressure changes from ships considered inaccurate?</p> <ol style="list-style-type: none">1. Improper observation technique2. Computational errors are too great3. They are uncorrected for movement and speed of the ships and pressure systems4. Improperly calibrated marine barographs |
| | <p>7-9. Why is the dewpoint temperature more representative than the ambient air temperature?</p> <ol style="list-style-type: none">1. It is not affected by moisture sources2. It is not affected by precipitation3. It is relatively unaffected by heating and cooling4. It is limited latitudinally |

7-10. Which of the following influences make(s) wind reports from land stations unrepresentative?

1. Local heating and cooling
2. Vegetation
3. Terrain
4. All of the above

7-11. Wind directions are most representative when the speed is

1. less than 3 knots
2. 3 - 5 knots
3. 5 - 8 knots
4. 10 knots or greater

7-12. Wind observations from coastal stations are more representative than those from ships.

1. True
2. False

7-13. Which of the following cloud types is NOT considered representative?

1. Cirrus
2. Altocumulus
3. Altostratus
4. Cumulus

7-14. Which of the following visibilities is classified as representative?

1. 1 mi
2. 3 mi
3. 5 mi
4. 7 mi

Learning Objective: Identify the procedures for drawing isobars on a plotted surface chart.

7-15. How are isobars normally labeled?

1. At one point on closed-loop isobars and at least two points on others using two digits
2. At one point only on all isobars using two digits
3. At two points on closed-loop isobars and at one point on all others using three digits
4. At two points on all isobars using two digits

7-16. What is considered the best place to begin an isobaric analysis?

1. In an area of few reports showing moderate winds
2. In an area of few reports showing weak winds
3. In an area of numerous reports showing weak winds
4. In an area of numerous reports showing moderate winds

7-17. Friction and the Earth's rotation cause what relationship between the isobars and wind directions over the oceans of the world?

1. The wind parallels the isobars
2. The isobars are at right angles to the wind
3. The wind crosses isobars at an angle of 10 to 20 degrees
4. The wind crosses isobars at an angle of 15 to 30 degrees

7-18. For a given wind speed, how, if at all, is the spacing of isobars affected latitudinally?

1. It decreases with a decrease in latitude
2. It decreases with an increase in latitude
3. It increases with an increase in latitude
4. The spacing is unaffected

7-19. How are the isobars spaced between two stations whose wind speeds are vastly different?

1. The isobars are spaced equidistant between the two stations
2. Spacing is based on the station with the lowest wind speed
3. Spacing is based on the station with highest wind speed
4. Isobars are more closely spaced near the station with the stronger wind

7-20. Geostrophic and gradient wind scales are based on

1. map scale only
2. map projection and scale
3. surface or upper-air use
4. pressure patterns

- 7-21. Why is the gradient wind a better approximation of the true wind than the geostrophic wind?
1. Friction is taken into effect
 2. The pressure field is considered unchanging
 3. The path of true wind is unchanging
 4. The path of true wind is more curved than straight
- 7-22. To find the geostrophic wind speed at some point on the latest weather chart, which of the following lists of information and/or items should you use?
1. The wind speed at the nearest station to the point of interest and a wind scale
 2. A wind scale and the distance between the isobars on either side of the point of interest
 3. The distance between the isobars on either side of the point of interest, the latitude of that point and a wind scale
 4. The latitude of the point of interest and a wind scale
- 7-23. You have just determined the geostrophic wind speed for a point in the North Atlantic. For plotting purposes, how should you determine the wind direction?
1. Assign a direction that parallels the isobars
 2. Assign a direction with a cross-isobar angle of 20 degrees
 3. Assign a direction with a cross-isobar angle of 35 degrees
 4. Assign a direction based on the wind scale and latitude of the point of interest
- 7-24. The geostrophic wind scale printed on a base map can be used to determine the
1. wind speed and direction
 2. latitude and wind direction
 3. latitude and spacing between isobars
 4. spacing between isobars and wind speed
- 7-25. Which combination of latitude and wind speed requires the greatest spacing between isobars?
1. 30° - 60 knots
 2. 40° - 35 knots
 3. 50° - 20 knots
 4. 60° - 10 knots

- 7-26. Over relatively flat terrain, what percentage of the geostrophic wind equates to the true wind?
1. 25%
 2. 33 1/3%
 3. 66 2/3%
 4. 75%
- 7-27. In late winter, a fresh outbreak of cPk air dominates the U.S. between the Rockies and the Appalachians; at the same time, east of the Appalachians warmer air prevails. How, if at all, is the isobaric spacing affected across the Appalachian range?
1. Isobars should be packed over the range
 2. Isobars should be widely spaced over the range
 3. Isobars should be packed west of the range
 4. Isobaric spacing is not affected

IN ANSWERING QUESTIONS 7-28 AND 7-29, MATCH THE DEFINITIONS IN COLUMN B WITH THE ISOBARIC PATTERNS LISTED IN COLUMN A.

		A. ISOBARIC PATTERNS	B. DEFINITIONS
7-28.	Col		1. An elongated area of relatively high pressure
7-29.	Ridge		2. An elongated area of relatively low pressure
			3. A region characterized by relatively low pressure and found between two highs and two lows

Learning Objective: Identify procedures used in locating fronts on a surface weather chart.

- 7-30. In which, if any, of the following areas will you most likely locate a cold front?
1. In a well-defined pressure trough
 2. To the rear of an area of isallobaric rises
 3. Through the center of a high-pressure ridge
 4. None of the above

- 7-31. Which of the following relationships does a "check" pressure tendency have with a cold front?
1. It signals a cold front's approach
 2. It indicates the cold front is within 3 hours of arriving at the station
 3. It is a postfrontal indication that the cold front passed the station within the last 3 hours
 4. It alerts one to a cold front's presence, but it does not indicate where the front is in relation to the station
- 7-32. In the Northern Hemisphere, which of the following lists of indications are pre-cold frontal?
1. Thunderstorms, southwest winds, falling dewpoint and rising pressure
 2. Clearing skies, northwest winds, falling dewpoint and rising pressure
 3. Low ceilings, northerly winds, rising pressure and falling temperature
 4. Thunderstorms, southwest winds, falling pressure and relatively warm temperatures
- 7-33. Rapid clearing is associated with all cold frontal passages.
1. True
 2. False
- 7-34. Between a cPk air mass and a mTw air mass, the polar front will be located
1. on the cold air side of the transition zone between the two air masses and along the line of anticyclonic curvature
 2. on the cold air side of the transition zone between the two air masses and along the line of cyclonic wind shear
 3. on the warm air side of the transition zone between the two air masses and along the line of cyclonic wind shear
 4. on the warm air side of the transition zone between the two air masses and along the line of anticyclonic curvature
- 7-35. Which of the following statements is true concerning secondary cold fronts?
1. They are far more common in Spring and Fall
 2. When they develop, the primary front intensifies
 3. They develop in the cold air several hundred miles to the rear of the primary front
 4. They form in the last stages of a tropical cyclone
- 7-36. Where will the strongest winds normally be found in relation to a warm front?
1. In the cold air prior to frontal passage
 2. In the warm air after frontal passage
 3. Approximately 300 miles in advance of the warm front
 4. On the warm air side of the transition zone
- 7-37. The (a) first pre-warm frontal clouds and (b) precipitation typically occur at which of the following distances?
1. (a) 1000 and (b) 300 miles
 2. (a) 700 and (b) 300 miles
 3. (a) 500 and (b) 200 miles
 4. (a) 300 and (b) 100 miles
- 7-38. Warm fronts (unless they are inactive) are much easier to locate than cold fronts.
1. True
 2. False
- 7-39. With a cold type occlusion, where is the most violent weather located?
1. South of the apex in the warm sector
 2. North of the apex ahead of the surface front
 3. 50 to 100 miles north of the northern tip of the warm sector along the upper front
 4. 50 to 100 miles north of the apex along the surface front
- 7-40. With a warm-type occlusion, high-level thunderstorms can be encountered as much as
1. 200 miles in advance of the surface front
 2. 400 miles in advance of the surface front
 3. 200 miles to the rear of the surface front
 4. 400 miles to the rear of the surface front

7-41. Which of the following analysis factors gives the best indication of the location of a quasi-stationary front?

1. Temperature contrast
2. Wind shift
3. Cloud cover
4. Pressure change

7-42. Which of the following stationary and nonfrontal troughs are most often incorrectly analyzed as a frontal trough?

1. Those found along the leeside of major mountain ranges
2. Those that form in the wake of well developed occluded cyclones over the oceans
3. Those associated with heat lows
4. All of the above

7-43. Without the benefit of a current satellite photograph, your first guess as to the current location of a front should be made using

1. wind directions and speeds
2. pressure tendencies
3. past history
4. temperatures and dewpoints

7-44. Why aren't the surface temperatures and dewpoints that border fronts representative of their respective air masses?

1. Horizontal mixing
2. Surface heating or cooling
3. Surface evaporation
4. For all of the above reasons

7-45. Which of the following occurrences is considered a common error in frontal analysis?



1. Isobars that intersect fronts kink toward low pressure
2. Frontal patterns with an impossible 3-dimensional structure
3. Failure to carry fronts that lose their identity due to daytime heating
4. Each of the above

Learning Objective: Identify the correct procedures for labeling the various features on an analyzed surface chart.



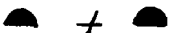

7-46. When are highs and lows labeled with a "U"?

1. When the central pressure is unknown
2. When the amount of pressure change since the last chart is unknown
3. When the center of the low or high is off the chart
4. When the center of the low or high is off the chart and the central pressure is unknown

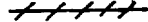
7-47. Which of the following series of symbols correctly shows tropical cyclone designations in increasing order?

1.  TD 
2.  TD 
3.   TD
4. TD  

7-48. Which of the following monochromatic symbols represents an upper warm front?

1. 
2. 
3. 
4. 

7-49. Which of the following polychromatic symbols represents a cold front undergoing frontolysis?

1. --- (blue)
2.  (blue)
3. (blue)
4. ——— (blue)

Learning Objective: Identify the procedures for depicting and analyzing frontal and pressure system movement, air masses, precipitation and obstructions to vision, and isallobars.

7-50. How is the speed of a front determined?

1. Using a hand held anemometer
2. Radiosondes
3. Using the geostrophic wind scales at the base of the weather map
4. It is computed using the distance the front has moved in degrees latitude



IN ANSWERING QUESTIONS 7-51 THROUGH 7-54
REFER TO THE FOLLOWING INFORMATION:

OVER THE LAST 24 HOURS A DEEPENING LOW-PRESSURE
SYSTEM MOVED THE FOLLOWING DISTANCES: 00Z TO
06Z - 180 NM; 06Z TO 12Z - 140 NM; 12Z TO 18Z
- 80 NM; AND 18Z TO 00Z - 30 NM.

- 7-51. What is the low's current speed?
1. 5 knots
 2. 10 knots
 3. 15 knots
 4. 35 knots
- 7-52. What was the speed of the low (in knots)
at 06Z, 12Z, 18Z, and 00Z?
1. 35, 15, 10, 5
 2. 30, 20, 15, 8
 3. 30, 23, 13, 5
 4. 15, 12, 5, 2
- 7-53. How many degrees of latitude did the low
move during each 6-hour period?
1. 3, 2.3, 1.3, .5
 2. 3.5, 1.5, 1.0 .8
 3. 3, 1.5, 1.0, .5
 4. 1.5, 1.2, .5, .2
- 7-54. What was the average speed (rounded off)
of the low over the last 24 hours?
1. 30 knots
 2. 21 knots
 3. 18 knots
 4. 12 knots
- 7-55. Air masses that invade the middle lati-
tudes can often be differentiated by
their temperatures and dew points. With
which of the following air masses is
this NOT possible?
1. mT
 2. cT
 3. cP
 4. cA
- 7-56. In winter, the leading edge of mTw air
invades the Gulf Coast states. The dew
point temperature representative of this
air mass is
1. 90° F
 2. 75° F
 3. 70° F
 4. 60°F
- 7-57. How are areas of showers marked on the
surface chart?
1. Shaded in green
 2. Shaded in yellow
 3. Green shower symbols
 4. Yellow shower symbols
- 7-58. In the absence of data, you should assume
that the precipitation shield in advance
of a warm front or warm-type occlusion
extends for how many miles?
1. 100
 2. 200
 3. 300
 4. 400
- 7-59. In the absence of ship reports, which of
the following plotted data should be your
first indication of a front approaching
a coastline?
1. Pressure falls
 2. Pressure tendencies
 3. An altostratus layer or "mid" 7
clouds
 4. Dew points
- 7-60. Lines of equal negative pressure
tendencies are known as
1. isobars
 2. isallobars
 3. katallobars
 4. anallobars
- 7-61. Where current sea-level pressures do not
differ from those recorded three hours
before, the station plots are connected
by a
1. dashed blue anallobar
 2. dashed red katallobar
 3. dashed purple isallobar
 4. solid red katallobar
- 7-62. Which of the following statements is true
concerning the zero isallobar?
1. When the zero isallobar lies to the
rear of a high-pressure center, the
high is intensifying
 2. When the zero isallobar is ahead of a
low-pressure center or trough, the
low or trough is filling
 3. The zero isallobar can be used to
determine whether the pressure
gradient is increasing or decreasing
 4. Each of the above is true

Learning Objective: Identify the differences between Northern and Southern Hemisphere analysis procedures.

7-63. The atmospheric circulation of the Southern Hemisphere differs from that of the Northern Hemisphere as a result of the

1. topographical differences
2. land and water distribution
3. negative Coriolis parameter
4. positive Coriolis parameter

7-64. The presence of heat lows south of the Amazon Basin, over northern Australia, and over the whole eastern part of South Africa are most likely to occur in which of the following time frames?

1. Dec. - Mar.
2. Mar. - Jun.
3. Jun. - Sep.
4. Sep. - Dec.

7-65. Which of the following air masses is the predominant air mass in the Southern Hemisphere?

1. mT
2. mP
3. mA
4. E

7-66. The semistationary polar troughs in the Southern Hemisphere are found along the

1. western border of the subtropical highs
2. eastern border of the subtropical highs
3. southeastern border of the subtropical highs
4. Antarctic ice shelf

7-67. Isobars drawn for the west coast of southern South America, Antarctica, and South Africa should be discontinuous because of the

1. lack of reports
2. negative coriolis parameter
3. severe elevation differences in these areas
4. air mass discontinuity in these areas

Assignment 8

Textbook Assignment: "Upper Air Analysis. " Pages 8-1-1 through 8-4-5.

Learning Objective: Determine the elements used in the preparation and analysis of upper-air charts.

- 8-1. Of the various types of upper-air observations, which type is considered the most accurate?
1. Satellite
 2. Aircraft
 3. Pibals
 4. Radiosonde
- 8-2. Pibal information is least reliable when the observation is taken in
1. warm core highs
 2. cold core highs
 3. areas of small vertical wind shear
 4. regions experiencing high winds
- 8-3. Over ninety percent of the time, temperatures obtained from radiosondes are accurate to within
1. 0.5°C
 2. 1.0°C
 3. 2.0°C
 4. 2.5°C
- 8-4. Which of the following computed relative humidities is most representative of a radiosonde passing through an ice crystal cloud layer?
1. 100%
 2. 90%
 3. 75%
 4. 50%
- 8-5. In what layer of the atmosphere are radiosondes most reliable and accurate?
1. Lower troposphere
 2. Upper troposphere
 3. Lower stratosphere
 4. Upper stratosphere

Learning Objective: Identify the analysis procedures used in analyzing constant-pressure, thickness, time-differential, jet stream and tropopause data.

- 8-6. How many hours of past history are normally carried forward on manually prepared constant-pressure charts?
1. 6
 2. 12
 3. 18
 4. 24
- 8-7. Extrapolating the height of a constant-pressure surface requires which of the following known variables?
1. Surface temperature, station pressure and height of the 1000-mb level
 2. Surface temperature, 1000-mb temperature, and sea-level pressure
 3. Surface temperature, sea-level pressure, and an assumed mean virtual temperature of the stratum in question
 4. Surface temperature, mean sea-level pressure and the 1000-mb height
- 8-8. What is the height of the 1000-mb level at a station with a sea-level pressure of 988.8 mb?
1. 11 meters below sea level
 2. 11 meters above sea level
 3. 90 meters below sea level
 4. 90 meters above sea level

- 8-9. When extrapolating upper heights, inversions must be compensated for by using a/an
1. lower estimate of the upper-level temperature
 2. higher estimate of the upper-level temperature
 3. corrected sea-level pressure
 4. adjustment of the height of the 1000-mb level
- 8-10. What is the standard height of the 500-mb level?
1. 1500 meters
 2. 5400 meters
 3. 5580 meters
 4. 5760 meters
- 8-11. The isoheights on an 850-mb chart are normally drawn at what interval?
1. 15 meters
 2. 30 meters
 3. 60 meters
 4. 120 meters
- 8-12. Which of the following statements concerning upper-level contours is correct?
1. All upper-level contours are drawn as solid black lines
 2. Contours are drawn at a 10 to 20 degree angle to the wind
 3. Contour spacing is inversely proportional to the wind speed
 4. Contours may touch in areas of subgradient winds
- 8-13. How should a height of 11,880 meters appear on a plotted 200-mb chart?
1. 118
 2. 188
 3. 880
 4. 1880
- 8-14. A check on the 3-dimensional representation of pressure systems and fronts is carried out
1. using a surface chart
 2. on a skew-T-Log P diagram
 3. by overlaying analyzed charts
 4. by simply checking radiosonde reports
- 8-15. In checking the vertical consistency of low-pressure systems, how do they normally stack?
1. The upper low is usually westward and equatorward of the surface position
 2. The upper low is usually eastward and equatorward of the surface position
 3. The upper low is usually westward and poleward of the surface position
 4. The upper low is usually eastward and poleward of the surface position
- 8-16. How far in advance of a surface warm front would you expect the front to intersect the 700-mb level?
1. Approximately 35 miles
 2. Approximately 90 miles
 3. No more than 175 miles
 4. At least 250 miles
- 8-17. If a past surface front's existence cannot be verified by the temperature and wind pattern at the 850-mb level, the front more than likely no longer exists and should not be carried forward.
1. True
 2. False
- 8-18. Dynamically, how do isotherm patterns relate to pressure ridges and troughs?
1. Warm tongues are associated with upper troughs and ridges
 2. Cold tongues are associated with upper troughs and ridges
 3. Warm tongues are associated with upper ridges and cold tongues with upper troughs
 4. Warm tongues are associated with upper troughs and cold tongues with upper ridges
- 8-19. Isotherms are normally drawn at what interval and in what color?
1. 2°C in blue
 2. 3°C in blue
 3. 5°C in red
 4. 10°C in red
- 8-20. Which of the following factors does NOT explain changes in temperature?
1. Addition of heat
 2. Subtraction of heat
 3. Adiabatic stability
 4. Advection

- 8-21. Which of the following factors slow(s) the advection of isotherms?
1. Subsidence
 2. Adiabatic lifting
 3. Both 1 and 2 are correct
 4. Supergradient winds
- 8-22. A polar outbreak that moves out over the warm waters of the Gulf Stream can be slowed by as much as
1. 10%
 2. 25%
 3. 35%
 4. 50%
- 8-23. In the Northern Hemisphere, if the wind backs with height, what is the isotherm-contour relationship?
1. The isotherms cross the contours in such a way that cold air advection takes place
 2. The isotherms cross the contours in such a way that warm air advection takes place
 3. The contours and isotherms are parallel with cold air to the left facing downstream
 4. The contours and isotherms are parallel with warm air to the left facing downstream
- 8-24. How does the thermal gradient (isotherm packing) indicate a front's strength?
1. The stronger the gradient, the stronger the front
 2. The weaker the gradient, the stronger the front
 3. The more perpendicular the gradient is to the front, the stronger the front
 4. Where the isotherms cross the front, the front is strongest
- 8-25. The 700-mb isotherms are representative of the mean isotherms between which of the following isobaric layers?
1. 1000 - 700-mb layer
 2. 1000 - 500-mb layer
 3. 850 - 500-mb layer
 4. 500 - 200-mb layer
- 8-26. What is the normal interval used in drawing isotachs?
1. 25 knots
 2. 20 knots
 3. 15 knots
 4. 10 knots
- 8-27. The areas of highest winds in an isotach analysis are known as
1. highs
 2. wind speed maxima
 3. jets
 4. waves
- 8-28. Where isotachs converge, how do they cross contours?
1. From higher to lower heights
 2. From lower to higher heights
 3. From north to south in the Northern Hemisphere
 4. From south to north in the Northern Hemisphere
- 8-29. To be classified as a jet stream, the winds must attain what minimum speed?
1. 25 knots
 2. 50 knots
 3. 60 knots
 4. 75 knots
- 8-30. What color is used to designate the principal jet axis on constant-pressure charts?
1. Purple
 2. Green
 3. Blue
 4. Red
- 8-31. What is the lowest constant-pressure level that provides good representation of jet streams, especially in the middle latitudes?
1. 700 mb
 2. 500 mb
 3. 300 mb
 4. 200 mb
- 8-32. During summer, the subtropical jet stream core is more likely to be visible on which constant-pressure chart?
1. 500-mb chart
 2. 300-mb chart
 3. 200-mb chart
 4. 100-mb chart
- 8-33. A balloon borne radiosonde will enter the tropopause layer at a greater height at which of the following locations?
1. Poles
 2. Mid latitudes
 3. Equator

8-34. An atmospheric sounding may indicate more than one tropopause?

1. True
2. False

8-35. Another name for a thickness chart is a

1. constant-pressure chart
2. time-differential chart
3. space-differential chart

8-36. Which of the following rules concerning the construction of a thickness chart is correct?

1. The thickness lines must always pass either from higher to lower heights, or lower to higher heights at both levels
2. Between any two thickness lines, there must be a contour of the other isobaric surfaces being used in the analysis
3. Between any two consecutive contours, there must be a contour of the other isobaric level or a thickness line
4. Each of the above analysis rules is correct

8-37. Advection analysis is usually carried out on which of the following charts?

1. Constant pressure
2. Space differential
3. Time differential
4. 850-mb

8-38. When looking downstream between two pressure levels you notice the lower pressure level is to the left. What type of advection is indicated?

1. Cold
2. Warm
3. Negative

8-39. Time-differential analyses are usually carried out every

1. 6 hours
2. 12 hours
3. 18 hours
4. 24 hours

8-40. Height differences obtained in a time-differential analysis are drawn at what interval?

1. 10 meters
2. 20 meters
3. 30 meters
4. 50 meters

Learning Objective: Identify the uses of constant-pressure charts commonly prepared and displayed in most weather offices.

8-41. What is the principal use of the 1000-mb chart?

1. To construct time-differential analysis
2. To construct space-differential analysis
3. To determine the representativeness of surface winds and temperatures
4. To verify the surface chart

8-42. On which constant-pressure chart are short waves a predominant feature?

1. 1000 mb
2. 850 mb
3. 700 mb
4. 300 mb

8-43. What constant-pressure chart represents the top of the lower half of the Earth's atmosphere?

1. 850 mb
2. 700 mb
3. 500 mb
4. 400 mb

8-44. On a scheduled cross-country winter flight out of N.A.S. Whidbey Island, Washington, an A-7 pilot requests jet stream information to lessen his flight time. Which constant-pressure chart would most likely be referred to at this time of year?

1. 100 mb
2. 200 mb
3. 300 mb
4. 500 mb

Learning Objective: Identify the circulation patterns of long waves, short waves, upper highs, and lows.

8-45. There are normally 4 or 5 long waves around the Northern Hemisphere at any one time.

1. True
2. False

- 8-46. At 40°N latitude, what is the normal rate of movement of long waves in degrees longitude?
1. .5 per day
 2. 1.0 per day
 3. 2.0 per day
 4. 3.0 per day
- 8-47. Short waves are NOT usually detectable above what isobaric level?
1. 1000 mb
 2. 850 mb
 3. 700 mb
 4. 500 mb
- 8-48. The eastward progression of short waves is very nearly that of the windflow at which of the following constant pressure levels?
1. 1000 mb
 2. 850 mb
 3. 700 mb
 4. 500 mb
- 8-49. The fastest moving frontal waves have what type of isotherm to contour relationship?
1. In phase and parallel
 2. In phase with the isotherms having less amplitude than the contours
 3. 90 degrees out of phase
 4. 180 degrees out of phase
- 8-50. Which of the following systems retains a closed circulation pattern well into the troposphere?
1. Siberian and Canadian highs
 2. Dynamic highs and lows
 3. Thermal lows
 4. Each of the above
- 8-51. Dynamic low-pressure systems are normally located
1. within the tropics
 2. within the Arctic
 3. north of the prevailing westerlies
 4. south of the prevailing westerlies

Learning Objective: Define cut-off highs and lows, blocks, zonal and meridional flow, and jet streams.

- 8-52. Which of the following statements is correct concerning cut-off systems?
1. Cut-off highs are located equatorward of the prevailing westerlies
 2. Cut-off highs form when cold polar air is advected equatorward into the base of a deep long-wave trough
 3. Cut-off lows are far more important than cut-off highs
 4. Cut-off highs are the valleys between mountains of cold air
- 8-53. In what season of the year are the normal west to east migratory systems most likely to be slowed or stopped?
1. Spring
 2. Summer
 3. Fall
 4. Winter
- 8-54. Blocking highs may be either warm core or dynamic; in either case, they cause a split in the mid-latitude westerlies.
1. True
 2. False
- 8-55. Zonal indices are based on horizontal pressure differences between which of the following latitude ranges?
1. 50 - 70° lat.
 2. 45 - 65° lat.
 3. 35 - 55° lat.
 4. 30 - 50° lat.
- 8-56. Which of the following Northern Hemisphere circulation patterns are classified as being associated with a low-zonal index situation?
1. No highs are present at higher latitudes and fronts are well north of their normal positions
 2. The subtropical highs are well north of their normal positions
 3. The Icelandic and Aleutian lows are weak, split and oriented north and south
 4. Each of the above

IN ANSWERING QUESTIONS 8-57 THROUGH 8-60, MATCH THE ZONAL INDICES IN COLUMN B WITH THE WEATHER PATTERNS IN COLUMN A.

A. WEATHER PATTERNS	B. ZONAL INDICES	
8-57. The number of long waves around the hemisphere decreases and a polar high stagnates over the Great Basin	1. High 2. Low 3. Increasing 4. Decreasing	8-65. Which of the following weather situations triggers the strongest jet streams? 1. A split of the polar-front jet 2. A merger of the polar-front and subtropical jets 3. The change from meridional to zonal flow 4. The change from zonal to meridional flow
8-58. Few polar outbreaks occur and generally mild weather persists in midlatitudes		8-66. Which, if any, of the following features is representative of the width of the core of a polar-front jet?
8-59. Atlantic and Pacific subtropical highs weaken, split, orient north and south, and move to positions farther south than normal		1. Isotherm packing at 500 mb 2. Width of the zone between multiple jet streams 3. Latitude difference between the surface front and its intersection with the 500-mb surface 4. None of the above
8-60. Cut-off centers are normal		8-67. What relationship, if any, exists between a family of migratory lows and jet maxima?
8-61. Which of the following statements about jet streams is correct? 1. They are continuous around the globe 2. They are only 2-dimensional 3. No wind shear is experienced in their cores 4. True jet streams do not merge or split		1. Each jet maximum has a low associated with it 2. Each low has an associated jet maximum 3. Only the lows which eventually occlude have an associated jet maximum 4. Only the unoccluded lows have associated jet maxima
8-62. During which of the following index cycles are multiple polar-front jet streams most common? 1. Low 2. High 3. Increasing 4. Decreasing		8-68. Where does the highest percentage of precipitation occur in relation to the jet axis? 1. Poleward 2. Equatorward 3. On the right side looking downstream 4. Along the axis
8-63. During a low index cycle, polar-front jet streams move equatorward at what average rate of speed? 1. 10 nmi per day 2. 20 nmi per day 3. 30 nmi per day 4. 40 nmi per day		8-69. The horizontal wind shear associated with polar front jet streams is normally greatest and located 1. in the core 2. on the warm air side of the axis 3. on the cold air side of the axis 4. below the core
8-64. The single jet stream depicted on hemispheric climatological charts is 1. the mean polar-front jet stream 2. the mean subtropical jet stream 3. a mean jet derived from all upper-level westerlies over a given period of time 4. a mean jet derived from the upper-level westerlies between 25 N/S and 45 N/S over a given period		8-70. Subtropical jet streams are more intense in summer than in winter. 1. True 2. False

8-71. Where and at what time of year does the tropical easterly jet stream come into being?

1. Caribbean Sea and Yucatan Peninsula in summer
2. Southeast Asia and the Phillipines in winter
3. Southeast Asia, India and Africa in summer
4. The Azores and northeast Africa in winter

8-72. Which of the following statements concerning the polar-night jet is correct?

1. It only occurs in the hemisphere experiencing summer
2. It is a year-round feature of the Northern Hemisphere polar region
3. Unlike other jet streams, it is found in the stratosphere

Learning Objective: Define convergence and divergence and describe the importance of each.

8-73. Convergence is defined as a/an

1. pressure build up in a layer of the atmosphere
2. accumulation of air within a layer of the atmosphere
3. depletion of air within a layer of the atmosphere

8-74. In which of the following layers do convergence and divergence reach a maximum?

1. 1000 - 850 mb
2. 700 - 500 mb
3. 300 - 200 mb
4. 200 - 100 mb

8-75. Which of the following statements is true concerning divergence?

1. It occurs where wind speeds increase downstream
2. It occurs in regions of uniform wind speeds if the winds split or fan out
3. It occurs in the vertical as well as the horizontal
4. Each of the above

Assignment 9

Textbook Assignment: "Upper Air Analysis (Continued)"; "Tropical Meteorology and Analysis."
Pages 8-5-1 through 9-3-15.

Learning Objective: Define vorticity, explain the two types, and explain how CAVT tables are used.

IN ANSWERING QUESTIONS 9-1 THROUGH 9-3, MATCH THE TERMS LISTED IN COLUMN B WITH ITS DEFINITION IN COLUMN A.

	<u>A. DEFINITIONS</u>	<u>B. TERMS</u>
9-1.	Occurs when spin is imparted to a parcel	1. Positive vorticity
9-2.	Spin created by wind shear and curvature	2. Vorticity
9-3.	Classification given to cyclonically turning parcels in the Northern Hemisphere	3. Relative vorticity
9-4.	What is the purpose of CAVT tables?	
	1. To track low-pressure systems	
	2. To measure vorticity	
	3. To determine long-wave movement	
	4. To measure relative vorticity	

Learning Objective: Recognize the weather differences that occur within the tropics, the representativeness of weather elements, and what drives our approach to analyzing the weather over this region.

- 9-5. The tropical latitudes are the source region for what air mass(es)?
- Equatorial only
 - Tropical only
 - Equatorial and tropical
 - Polar, equatorial and tropical
- 9-6. Why are polar fronts difficult to locate in the tropics?
- Topographical extremes
 - Lack of reporting stations
 - Polar air is quickly modified, making for minimal temperature contrast across the front
 - Polar air masses do not penetrate tropical latitudes
- 9-7. With many polar fronts that enter the tropics and are modified, the only clues to their continued existence is
- the temperature and dewpoint contrast
 - lower- and upper-level cyclonic wind shear
 - temperature contrast across the fronts and the fronts' associated convected activity
 - convective activity produced by low-level cyclonic wind shear
- 9-8. In what tropical wind belt(s) will you find the Intertropical Convergence Zone (ITCZ)?
- Doldrums only
 - Horse latitudes only
 - Trades only
 - Doldrums and horse latitudes

- 9-9. The tropical wind belts shift north and south with the seasons. By July, the equatorial low-pressure trough is located
1. in the horse latitudes of the Northern Hemisphere
 2. near the equator but entirely in the Northern Hemisphere
 3. a few degrees into the Southern Hemisphere
 4. in and around the equator encompassing both hemispheres
- 9-10. The width of the doldrum belt is indirectly related to
1. the seasons
 2. diurnal pressure changes
 3. the strength of the tradewinds
 4. the geography of the area
- 9-11. What is the dominant feature of the horse latitudes?
1. ITCZ
 2. The subtropical high-pressure centers
 3. The equatorial low-pressure trough
 4. Strong westerlies
- 9-12. Which of these weather occurrence's characterize the trade wind belts separating the doldrums and horse latitudes?
1. Fair weather cumulus clouds
 2. Moderate northeasterly winds in the Northern Hemisphere and southeasterly winds in the Southern Hemisphere
 3. Low-level temperature inversions
 4. Each of the above
- 9-13. In which tropical area is the trade inversion most pronounced?
1. Midoceanic
 2. Mountainous islands
 3. West coasts of continents
 4. Eastern portions of the ocean
- 9-14. The tradewind inversion has a significant effect on the weather in the tropics. Which of the following types of weather is most likely to occur when the inversion lowers?
1. Significant convective activity
 2. Extensive cloud cover
 3. Rain
 4. Haze
- 9-15. What is the mean air temperature over tropical oceans?
1. 70°F
 2. 75°F
 3. 80°F
 4. 85°F
- 9-16. With regard to mountainous tropical islands, when and where do convective clouds reach their maximum vertical extent?
1. On the leeward side at night
 2. On the windward side at night
 3. On the leeward side during the day
 4. On the windward side during the day
- 9-17. Temperature and pressure variations in the tropics are greatest over which of the following physical features?
1. Islands
 2. Water
 3. Coasts
 4. Continents
- 9-18. Which of the following occurrences cause(s) many continental tropical areas to experience wet and dry seasons?
1. Monsoons only
 2. Latitudinal shifts in the wind belts only
 3. Monsoons and latitudinal shifts in the wind belts
- 9-19. What is the most predominant cloud type found in the tropics?
1. Cumulonimbus
 2. Cumulus
 3. Stratocumulus
 4. Cirrus
- 9-20. Over what region of the tropics would you expect to find an abundance of isolated high clouds?
1. Within the trade wind belt and associated with the subtropical jet stream
 2. East of the subtropical high-pressure centers in tongues of warm upper-level air
 3. In the doldrums from anvil tops of cumulonimbus clouds
 4. Within the horse latitudes associated with the higher pressure

9-21. Surface winds are not always representative of actual conditions. Where do we find the most representative surface winds in the tropics?

1. Island mountains
2. Along coasts
3. At sea in the vicinity of rainshowers
4. Over flat stretches of land during the day

9-22. Three-hour pressure tendencies are reported in midlatitudes. Except in the vicinity of tropical storms, why aren't three-hour pressure tendencies reported in the tropics?

1. The three-hour change is too small
2. The day to night change in pressure masks any synoptic change
3. Cloud systems passing over a station often cause a .1 millibar change in barometric pressure
4. For all the above reasons

9-23. Twenty-four hour pressure changes of what magnitude warrant careful attention by the analyst?

1. .1 to 1.0 mb
2. .5 to 1.0 mb
3. 1.0 to 1.5 mb
4. 1.5 to 2.5 mb

9-24. At which of the following tropical locations would you expect to find the most representative temperatures?

1. On the lee side of mountainous islands at night
2. On small, flat islands well removed from continental effects
3. In the vicinity of rainshower activity
4. At the fringes of the tropics

Learning Objective: Recognize analysis procedures for time sections, low- and upper-level streamlines, surface and upper-air charts, 24-hour pressure change charts, and weather distribution charts.

9-25. Why is the analysis of time sections at key stations within the tropics considered important?

1. Most of the weather changes in the tropics are directly time related
2. It is an effective way of denoting diurnal changes
3. Errors and unrepresentative values in station reports are easily detected
4. All the above are reasons

9-26. Time-cross sections are an effective tool for determining the representativeness of 24-hour height changes within the atmosphere. When marked upper-height falls (30 mtrs/24-hours) are noted in data taken off the 1200z sounding from a key station and are followed by rises of similar magnitude at 0000z, what should the analyst assume?

1. A tropical disturbance moved over the station
2. The radiosonde observations at the stations are correct
3. One of the radiosonde observations is in error until a check of the wind and weather changes prove otherwise
4. That weather conditions are normal, because 30 mtr height changes in a 24-hour period are common in the tropics

9-27. How are trough or shear lines distinguished on a time section?

1. Orange line
2. Purple alternating dots and dashes
3. Blue dashes
4. Red dashes

9-28. In what increments are 24-hour height change contours drawn on time sections?

1. 30 meters
2. 30 meters above 400 mb and 15 meters below 400 mb
3. 60 meters above 500 mb and 30 meters below 500 mb
4. 60 meters

- 9-29. The strength of tropical inversions plays an important part in determining the type of weather that will occur. What is/are the best measure(s) of inversion strength?
1. The difference in ambient temperature between the top and bottom of the inversion layer
 2. The difference in potential temperature between the top and bottom of the inversion layer
 3. The thickness of the inversion layer
 4. Both 2 and 3 are best
-
- Learning Objective: Identify techniques applied in performing tropical analysis, and recognize the types of analyses which may be performed.
-
- 9-30. Weather occurrences in the tropics are more apt to be explained using wind analyses.
1. True
 2. False
- 9-31. What is/are the most common level(s) used in tropical streamline analysis?
1. Surface
 2. 850-mb level
 3. 500-mb level
 4. Gradient level and the 300- or 200-mb level depending on the time of year
- 9-32. Which of the following cumulus cloud patterns is most apt to provide the best indication of the surface wind?
1. Long, wide cloud lines with narrow openings
 2. Very short, narrow, zig-zagging lines
 3. Long, narrow, straight lines
 4. Very long, very narrow, wavy lines
- 9-33. Which, if any, of the following features is a drawback to conducting a streamline analysis of the gradient wind level?
1. The wind fluctuations are extreme in the trade wind belt
 2. Orographic influences
 3. Non-availability of gradient wind observations
 4. None of the above
- 9-34. Satellite pictures are often used to determine upper-level windflow. What is/are the most useful cloud pattern(s) used for this purpose?
1. Cirrus cloud shields associated with subtropical jet streams
 2. Cirrus spissatus (plumes of cirrus associated with cumulonimbus)
 3. Both 1 and 2 are most useful
 4. Transverse cirrus bands
- 9-35. The recommended and most complete method of streamline analysis is the
1. discontinuous method
 2. qualitative method
 3. isotach method
 4. streamline-isotach method
- 9-36. Why is discontinuous streamline analysis more suitable for upper levels?
1. Far fewer reports are available at these levels
 2. Light winds prevail
 3. Fairly strong winds prevail
 4. Most of the winds at these levels must be discarded
- 9-37. Streamlines in the wind field away from which neighboring streamlines diverge are known as
1. negative asymptotes
 2. positive asymptotes
 3. singular points
 4. cusps
- 9-38. Which of the following streamline analysis features are analogous to a col?
1. Vortices
 2. Anticyclonic outdrafts
 3. Cyclonic outdrafts
 4. Neutral points
- 9-39. The recommended area to begin a streamline analysis is the
1. doldrums
 2. tradewind belt
 3. subtropical high-pressure belt
 4. area poleward of the subtropical ridge
- 9-40. What is the correct isotach interval used in streamline analysis?
1. 5 knots
 2. 5 knots up to 20 knots, then every 10 knots thereafter
 3. 5 knots up to 25 knots, then every 10 knots thereafter
 4. 10 knots

- 9-41. An area shaded in purple on a streamline analysis is representative of
1. an area of wind speeds 20 knots or greater
 2. an area of wind speeds 30 knots or greater
 3. an area of wind speeds 10 knots or less
 4. an area of wind speeds that are less than 5 knots
- 9-42. Isotachs kink when they cross streamlines.
1. True
 2. False
- 9-43. The general effect of increasingly stronger convergence is an increase in
1. all cloud types and amounts
 2. convective cloud heights
 3. mid cloud amounts
 4. high cloud amounts
- 9-44. Where low-level streamlines indicate moderate to strong divergence, what is the predominant cloud type found over such an area?
1. Stratus
 2. Cumulus humilis
 3. Cumulus congestus
 4. Cumulonimbus
- 9-45. When a weather distribution analysis is made without the benefit of previous distribution charts, the first thing you should do is to
1. outline the middle clouds
 2. outline the high clouds
 3. study the available aircraft reports
 4. study the climatology of the analysis area
- 9-46. Isobaric analysis is NOT the most important tool of the tropical meteorologist because of this region's weak pressure gradient. To compensate for the gradient, isobars are normally drawn at what intervals over the horse latitudes, trades and doldrums respectively?
1. 4 mb, 4 mb, and 2 mb
 2. 4 mb, 2 mb, and 2 mb
 3. 4 mb, 2 mb, and 1 mb
 4. 2 mb, 2 mb, and 2 mb
- 9-47. An area on a weather distribution chart showing few middle and high clouds and large amounts of cumulus humilis indicates
1. suppressed convection
 2. an approaching storm
 3. the normal cloud distribution in the tropics
 4. the beginning of the dry season
- 9-48. As a check on the isobaric analysis of tropical oceans, the analyst should
1. personally check each individual pressure report
 2. analyze the 3-hourly isallobaric field
 3. analyze the 24-hour pressure changes
 4. check the weather distribution chart
- 9-49. What constant-pressure surface is considered the best level for tropical upper-air analysis?
1. 1000 mb
 2. 700 mb
 3. 500 mb
 4. 200 mb
- 9-50. How can you be reasonably certain an upper-air analysis is in error?
1. The upper heights are radically different from norms shown on frequency distribution charts
 2. A large area of cold or warm air suddenly appears without a foundation in continuity
 3. The thickness fields shown on the charts immediately preceding the current chart differ radically
 4. All of the above are indicators
- 9-51. What is the primary chart used in differential analysis in the tropics?
1. 1000 mb
 2. 700 mb
 3. 500 mb
 4. 200 mb
-
- Learning Objective: Distinguish between the various types of tropical phenomena, and identify characteristics of tropical systems in preparation for tropical analysis.
-

9-52. A line or narrow zone across which there is an abrupt change in the horizontal wind component parallel to this area is known as

1. a tropical wave
2. a shear line
3. an induced trough
4. an intense intertropical front

9-53. Which of the following is an example of a shear line?

1. Monsoon
2. Upper tropospheric ridge
3. Remnant of an old cold front in the tropics
4. Each of the above

9-54. On transiting poleward through the trades, your task group passes beneath a rather extensive cloud band. Periods of rain and instability showers reduce the visibility and lower the ceiling. The wind speed doubles but the east-northeast wind direction does not change. The latest weather map shows no front in the area. Which of the following tropical phenomena is most likely being encountered?

1. The ITCZ
2. An easterly wave
3. A shear line
4. An induced trough

9-55. It is 0800Z and you have just completed the 0600Z surface analysis. A stable easterly wave has formed and is positioned 60 miles east of your station. Since there is no past history with which to gauge the wave's speed, your best guess as to its time of arrival at your station would be

1. today at 1200Z
2. today at 1400Z
3. this evening at 1800Z
4. tomorrow at 0600Z

9-56. In reference to the Intertropical convergence Zone (ITCZ), which of the following statements would be considered correct?

1. The cloud band may be continuous for thousands of miles, while at other times it is discontinuous
2. Vertical cloud patterns may exist within the ITCZ
3. Disturbances may form within the cloud band of the ITCZ
4. All of the above statements are correct

9-57. Where the ITCZ lies over continents, when does the maximum and minimum rainfall occur?

1. Maximum - around noon; minimum - just before dawn
2. Maximum - just before dawn; minimum - late morning
3. Maximum - early afternoon; minimum - around midnight
4. Maximum - just before dawn; minimum - just before nightfall

9-58. Which statement concerning tropical cyclones is correct?

1. Tropical cyclones are small in comparison to extra-tropical cyclones
2. Tropical cyclones rank second to tornadoes in their level of destructiveness
3. Tropical cyclones are distinctly different depending on the region in which they form
4. Tropical cyclones are classified according to the size of their closed circulation

IN QUESTIONS 9-59 THROUGH 9-61, SELECT FROM COLUMN B THE TROPICAL CYCLONE STAGE IDENTIFIED WITH THE OCCURRENCE OF EACH EVENT LISTED IN COLUMN A.

A. EVENTS

B. STAGES

9-59. The transformation of the storm into an extra-tropical cyclone

1. Formative
2. Immature

9-60. The appearance of westerly winds in low tropical latitudes where easterly winds normally prevail

3. Mature
4. Decaying

9-61. The organization of the wind system into a tight, symmetrical ring around the eye

9-62. When a tropical storm is moving in a westerly direction in the Northern Hemisphere, the strongest winds are usually found in which section of the storm?

1. Left front quadrant
2. Right front quadrant
3. Left rear quadrant
4. Right rear quadrant

- 9-63. The most significant cloud types found within a tropical cyclone are
1. precipitating middle clouds
 2. the advance cirrus and cirrostratus
 3. heavy cumulus and cumulonimbus
 4. all the low cloud species
- 9-64. One of the characteristics of the eye of a tropical cyclone is a sudden
1. decrease in the wind speed
 2. decrease in temperature
 3. increase in cloudiness
 4. increase in the intensity of the precipitation
- 9-65. Your ship is operating in the Caribbean Sea in the month of September and encounters heavy swell waves with periods of 9 to 15 seconds. What, if anything, might these waves signify?
1. The season's first extratropical cyclone
 2. A surge in the trade winds
 3. The presence of a tropical storm within the Caribbean or the southern North Atlantic Ocean
 4. Nothing - these waves are common in the trades
- 9-66. Unless a tropical cyclone is unusually developed, the 200-mb level is marked by
1. cyclonic inflow
 2. cyclonic outflow
 3. anticyclonic inflow
 4. anticyclonic outflow

IN QUESTIONS 9-67 THROUGH 9-69, SELECT FROM COLUMN B THE DATES OF HIGHEST FREQUENCY OF TROPICAL CYCLONE FORMATION IN THE AREAS LISTED IN COLUMN A.

A. AREAS	B. DATES
9-67. Gulf of Mexico	1. Jan. through Mar.
9-68. Coral Sea and West of Tuamotu Islands	2. Jun. through Nov.
	3. Jul. through Oct.
9-69. Marshall, Caroline, and Phillipine Islands and China Sea	4. Aug. through Oct.

- 9-70. Your ship is operating in the Sea of Japan. Which of the following facilities has the responsibility of issuing tropical advisories/warnings for this area?
1. National Weather Service (NWS) Hurricane Center Miami, Florida
 2. NWS Hurricane Center Pearl Harbor, Hawaii
 3. NAVWESTOCEANCEN Pearl Harbor, Hawaii
 4. NAVOCEANCOMCEN Joint Typhoon Warning Center at Guam
- 9-71. After the latest hurricane warning is plotted, the track shows the hurricane will get close enough to your station to generate hurricane force winds within 72 hours. What condition of readiness should be set?
1. Hurricane Condition I
 2. Hurricane Condition II
 3. Hurricane Condition III
 4. Hurricane Condition IV
- 9-72. During what season and over what regions is the tropical easterly jet stream a persistent feature?
1. Summer over southern Europe and northern Africa
 2. Summer over extreme southern Asia and northern Africa
 3. Winter over extreme southern Asia and northern Africa
 4. Winter over southern Europe and northern Africa
- 9-73. The tropical easterly jet stream flows east to west and the coldest air is found on the equatorward side of its axis.
1. True
 2. False

Assignment 10

Textbook Assignment: "Satellite, Radar and LDATS Imagery Interpretation." Pages 10-1-1 through 10-4-8.

<hr/> <p>Learning Objective: Identify and differentiate between the types of satellite imagery.</p> <hr/>	
10-1. What type of satellite imagery is produced using reflected sunlight?	10-6. What is the most easily interpreted portion of a satellite picture?
1. Composite	1. The area at or near the center
2. Visual	2. The eastern portion or right side
3. Infrared	3. The western portion or left side
4. Enhanced infrared	4. The right or left side depending on the time of day
10-2. Which of the following conditions is most apt to be the cause for an early morning visual picture being received partially or totally black?	10-7. What type(s) of imagery is/are produced by measuring electromagnetic energy?
1. Defective gray scale	1. IR only
2. Lack of sunlight	2. IR and EIR
3. Highly reflective source region	3. Visual
4. Over abundance of moisture	4. Composite
10-3. Why do water surfaces show up dark in visual pictures?	10-8. What is the primary difference between EIR and IR imagery?
1. Low albedo	1. Color
2. High albedo	2. Quality
3. Low absorbance rate	3. Type of radiometer
4. High absorbance rate	4. EIR images are produced using non-standard temperature-gray scales, IR images are produced using a standard temperature-gray scale
10-4. Thick clouds are more reflective than thin clouds and therefore show up better in visual imagery.	10-9. What type of imagery is used primarily in severe storm analysis?
1. True	1. Visual
2. False	2. IR
	3. EIR
	4. Composite
10-5. Viewed from space, which of the following surfaces has the greatest reflectivity?	10-10. What is/are the purpose(s) of enhanced temperature curves?
1. Desert	1. To gain greater definition of features
2. 3 to 7 day old snow	2. To increase feature contrast in certain temperature ranges
3. Thin cirrostratus	3. Easier recognition of significant features
4. Thundercloud	4. All of the above

- 10-11. What type(s) of imagery use(s) modified temperature-gray scales?
1. Visual
 2. IR
 3. EIR
 4. All the above

Learning Objective: Recognize the effects of latitudinal, seasonal and diurnal temperature variations on IR sensors.

- 10-12. When is it difficult to differentiate between land and water surfaces with IR imagery?
1. Midday
 2. Near dusk and dawn
 3. Anytime land and water temperatures contrast significantly
 4. Anytime land and water temperatures do not differ
- 10-13. Seen in IR imagery, mid and high clouds are most easily differentiated from land masses over what region of the Earth?
1. Tropics
 2. Midlatitudes
 3. Polar
 4. Arctic

Learning Objective: Identify and differentiate the cloud patterns and types of clouds seen in satellite imagery.

- 10-14. Which of the following cloud features provide a good indication of the surface and low-level wind direction?
1. Elements
 2. Streets
 3. Lines
 4. Bands
- 10-15. By definition, a frontal cloud band must have a length to width ratio of at least
1. 7 to 1
 2. 6 to 1
 3. 5 to 1
 4. 4 to 1

- 10-16. What is the most common cloud formation seen in satellite pictures?

1. Cloud elements
2. Cloud streets
3. Open and closed cells
4. Eddies

- 10-17. Open-and-closed-cellular cloud formations are associated with regions experiencing what type of advection?

1. Cold
2. Warm
3. Positive
4. Negative

- 10-18. Where is the jet stream in relation to open-and-closed-cell cumulus?

1. South of the closed Cu
2. North of the open Cu
3. Along the eastern border
4. Along the line of transition between the open and closed cells

- 10-19. A bright comma-shaped cloud formation often found in the cold air to the rear of a cold front signifies

1. a dissipating jet stream
2. an area of maximum positive vorticity
3. low-level wind shear
4. upper-level wind shear

- 10-20. Seen in IR imagery, the shading of cirrus layers is dependent on the temperature of the cirrus or the surface immediately below, the thickness of the cirrus, and the

1. Sun's angle
2. atmospheric temperature structure
3. cirrus texture
4. overall cloud pattern

- 10-21. When seen in IR imagery, why do cirrus clouds over the polar regions occasionally appear darker than the underlying snow cover?

1. They are lower and warmer at the poles
2. They are higher and colder at the poles
3. Strong temperature inversions
4. Lack of temperature inversions

- 10-22. How is the upper-level wind direction determined using the cirrus spissatus associated with cumulonimbus?
1. The cirrus is thin and wispy on the downwind side
 2. It produces a sharp boundary downwind
 3. The cirrus is thin and wispy on the upwind side
 4. It produces a sharp boundary upwind
- 10-23. Which of the following statements is correct regarding convective activity seen in IR imagery?
1. Small, low-level Cu are bright white
 2. The brighter the Cu, the greater its height
 3. Lower Cu casts the largest shadows
 4. Each of the above

IN ANSWERING QUESTIONS 10-24 THROUGH 10-27, MATCH THE CLOUDS VISUAL OR IR DESCRIPTION IN COLUMN B WITH ITS NAME IN COLUMN A.

	<u>A. CLOUDS</u>	<u>B. DESCRIPTIONS</u>
10-24.	Stratus	1. (Vis) Very bright white, with uniform texture
10-25.	Cirrus	
10-26.	Cumulus	2. (Vis) Light gray and often not visible when thin
10-27.	Altostratus	3. (IR) Pebble or cobble-stone appearance with shades ranging from dark gray to white depending on vertical extent
		4. (Vis) Smooth uniform appearance with milky white shading

Learning Objective: Identify sub-synoptic and synoptic scale cloud features seen in imagery and relate these features to surface and upper-air analysis.

- 10-28. Why are frontal cloud bands less likely to be continuous and easily recognized over land than over water?
1. Extreme temperature variations
 2. Greater atmospheric stability
 3. Lack of moisture

- 10-29. Which of the following frontal cloud bands is the most difficult to locate from imagery?

1. Occluded front
2. Active quasi-stationary front
3. Inactive warm front
4. Inactive cold front

- 10-30. A comma-shaped PVA maximum moving along the poleward side of an east-west oriented stationary front is often interpreted as

1. an occlusion
2. a stable wave
3. an unstable wave
4. an anticyclonic vortex

- 10-31. What may be analyzed when there is a bulge in a frontal cloud band?

1. PVA
2. A frontal wave
3. A short-wave trough
4. A long-wave trough

- 10-32. In IR imagery, frontal waves may appear extensively white or gray. What, if anything, does this shading indicate?

1. The grayer the shading, the more stable the wave
2. The whiter the shading, the more unstable the wave
3. Both 1 and 2 are correct
4. Nothing

- 10-33. Which of the following fronts is often found in the tropics in an east-west orientation and primarily consists of a fragmented band of high clouds?

1. An inactive cold front
2. An active warm front
3. An active quasi-stationary front
4. An inactive quasi-stationary front

IN ANSWERING QUESTIONS 10-34 THROUGH 10-37, MATCH THE POSITION WITHIN THE FRONTAL CLOUD BAND IN COLUMN B WITH THE FRONT IN COLUMN A.

	<u>A. FRONTS</u>	<u>B. POSITION</u>
10-34.	Active, slow moving cold front	1. At leading edge along line of maximum convective activity
10-35.	Occluded front	2. At trailing edge along line of maximum convective activity
10-36.	Fast moving cold front	
10-37.	Warm front	3. Along the band's trailing edge
		4. For the most part indeterminable

10-38. Which of the following occurrences indicates that an extra-tropical cyclone is intensifying?

1. Cirrus outflow ahead of system
2. A cold dry-air slot penetrating the vortex
3. A cloudy vortex
4. Each of the above

10-39. The presence of sunglint in visual satellite photos is an indication of which of the following conditions?

1. Positive vorticity advection
2. A high-pressure area
3. A low-pressure area
4. Rough seas

10-40. Which of the following cloud features seen in imagery identifies an easterly (tropical) wave?

1. Curved cloud lines
2. Spiraling cloud lines
3. Inverted V-shaped cloud patterns
4. Each of the above

10-41. A dense mass of cumuliform, cirriform, and layered mid clouds without recognizable shape or form appears in imagery adjacent to the ITCZ over the north Pacific Ocean. What diameter must this cloud mass have in order to be considered suspect for tropical cyclone formation?

1. 1° latitude
2. 2° latitude
3. 3° latitude
4. 6° latitude

10-42. At what stage(s) of development might a tropical cyclone appear well organized in daylight imagery and quite disorganized in nighttime imagery?

1. Formative
2. Weak tropical storm
3. Both 1 and 2 above
4. Weak hurricane

10-43. After a suspect tropical cloud mass has taken the shape of curved bands or lines, how many hours does it normally take before tropical storm force winds are generated?

1. 12 hr
2. 24 hr
3. 36 hr
4. 48 hr

Learning Objective: Determine the intensity of tropical cyclones using satellite imagery and the Dvorak technique.

IN ANSWERING QUESTIONS 10-44 THROUGH 10-47, MATCH THE PROPER DEFINITIONS IN COLUMN B WITH THE TERM USED IN TROPICAL CYCLONE INTENSITY ANALYSIS FROM COLUMN A.

	<u>A. TERMS</u>	<u>B. DEFINITIONS</u>
10-44.	Cloud system center	1. Amount of cloud system coiling
10-45.	Central features	2. A dense overcast covering the most tightly curved cloud bands
10-46.	Central dense overcast	3. The character of the cloud mass associated with the cloud system center and the overcast around the center
10-47.	Banding features	4. The focal point of all curved cloud lines/bands of a tropical system

10-48. The Dvorak technique is applicable to what type(s) of imagery?

1. Visual only
2. IR only
3. Visual and IR only
4. Visual, IR and EIR

10-49. Which of the following cloud types is a major problem in estimating a tropical cyclone's intensity from IR pictures?

1. Wall
2. Cirrus
3. Nimbostratus
4. Cumulus

10-50. What is the most common tropical cyclone cloud pattern seen in imagery?

1. Central dense overcast (CDO)
2. Shear
3. Curved band
4. Central cold cover

10-51. Tropical cyclone intensity estimates determined by the curved band cloud pattern are based on

1. the width of the cloud band
2. the diameter of the banding
3. the extent to which the band encircles the cloud system center
4. developmental time

10-52. When an eye forms within a CDO cloud pattern, upon what factor(s) is/are intensity estimates based?

1. Distance between the eye and outer boundary of CDO
2. CDO size
3. Eye size
4. Upon all the above factors

10-53. When, if ever, are "models" of tropical cyclone cloud patterns used in the Dvorak technique?

1. When setting limits on estimates made using cloud feature measurements
2. When cloud feature measurements are not possible
3. Both 1 and 2 above
4. Never

Learning Objective: Relate upper-air features to cloud patterns seen in imagery.

10-54. Upper-level ridges are located in imagery by the distribution of what cloud genera?

1. Mid clouds only
2. High clouds only
3. Mid and high clouds
4. low clouds

10-55. Where is the 500-mb trough positioned in relation to a comma-shaped (PVA) cloud pattern?

1. Along the eastern periphery
2. Along the western periphery
3. Through the center of the pattern
4. Where the pattern changes from smooth and continuous to ragged and discontinuous

10-56. What cloud pattern is most frequently associated with a polar-front jet stream?

1. Long, narrow streaks of cirrus
2. Tranverse bands of cirrus
3. An anticyclonically-curved cirrus deck with a sharp poleward boundary
4. A combined cumulonimbus and cirrocumulus pattern

Learning Objective: Describe the Earth's surface features as seen in visual and IR imagery.

10-57. More of the Earth's surface features are detected in IR imagery than visual.

1. True
2. False

10-58. How do water surfaces differ in appearance in IR and visual pictures?

1. IR shades water black, while visual sensors shade it lighter
2. IR shades water milky white, and visual sensors show it black
3. IR shading is dark, while visual shading is varied
4. IR shading is varied while visual shading is always dark

10-59. What makes some mountain ranges more visible in IR pictures than similar ranges at the same latitude?

1. Absence of snow cover
2. Presence of snow cover
3. Strong temperature gradient between top of range and adjacent valleys
4. Weak temperature gradient between range tops and adjacent valleys

Learning Objective: Identify radar weather echoes on the PPI and RHI scopes.

- 10-60. The PPI scope is painting two isolated rainshower echoes at 210 degrees and 240 degrees. How are the echoes categorized for message transmission?
1. Areas
 2. Cells
 3. Centers
 4. Fine lines
- 10-61. How is the return echo of a thunderstorm usually distinguished from other echoes?
1. By the size of the echo
 2. By the sharpness and brightness of its return
 3. By its softness in contrast to other returns
 4. By each of the above
- 10-62. You discover a precipitation area on the PPI and wish to determine the type of precipitation. The echo is of medium sharpness, and when you reduce the gain setting, the echo becomes smaller and smaller but does NOT disappear. What type(s) of precipitation is/are probably indicated?
1. Rain
 2. Snow only
 3. Hail only
 4. Snow and hail
- 10-63. You discover a line of sharp echoes on the PPI when your gain setting is low. As you increase the gain, the individual echoes merge with the blanket of echoes in a broad line. This indicates which of the following weather phenomena?
1. A weak cold front
 2. A strong cold front
 3. A warm front
 4. A squall line
- 10-64. You observe a system of echoes on the PPI scope which looks very much like a warm frontal pattern, but as the system moves closer to the station, it evolves into echoes of concentric bands spiraling slightly into the center. What does this system of echoes indicate?
1. A tornado
 2. A tropical cyclone
 3. The tip of a wave where a warm front turns to a cold front
 4. All the above
- 10-65. You observe a hook or an eye in a thunderstorm cell on the PPI. This condition is an indication of
1. hail
 2. certain tornado activity
 3. possible, but not certain, tornado activity
 4. nothing significant in relation to the thunderstorm
- 10-66. In the melting process, what is the normal position of the bright band in relation to the 0 degree isotherm on the RHI scope?
1. 1000 feet below
 2. 1000 feet above
 3. 3000 feet below
 4. 3000 feet above
- 10-67. You are examining an RHI scope for the bright band, but you can not detect one among the mass of strong echoes. This is an indication of
1. mild convection
 2. strong convection
 3. neutral convection
 4. great stability
- 10-68. Upon observing several layers of stratiform clouds on the RHI scope, you determine the main layer by
1. measuring the horizontal extent of the layers
 2. measuring the vertical thickness of the layers
 3. increasing the gain until only one layer remains
 4. decreasing the gain until only one layer remains
-
- Learning Objective: Recognize the capability of the Lightning Detection and Tracking System (LDATS) and interpret its video and printer presentations.
-
- 10-69. How do lightning strokes appear on LDATS monitors?
1. As they appear in nature
 2. As blocks
 3. As dots
 4. As coded letters

10-70. At what interval (in minutes) does the lightning stroke color presentation change?

1. 2 min
2. 5 min
3. 10 min
4. 15 min

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